Guiding principles of CTO’s treatment

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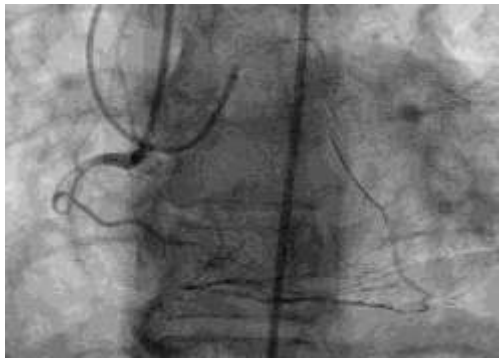
EuroCTO Club Member and Coordinator, Russian Federation

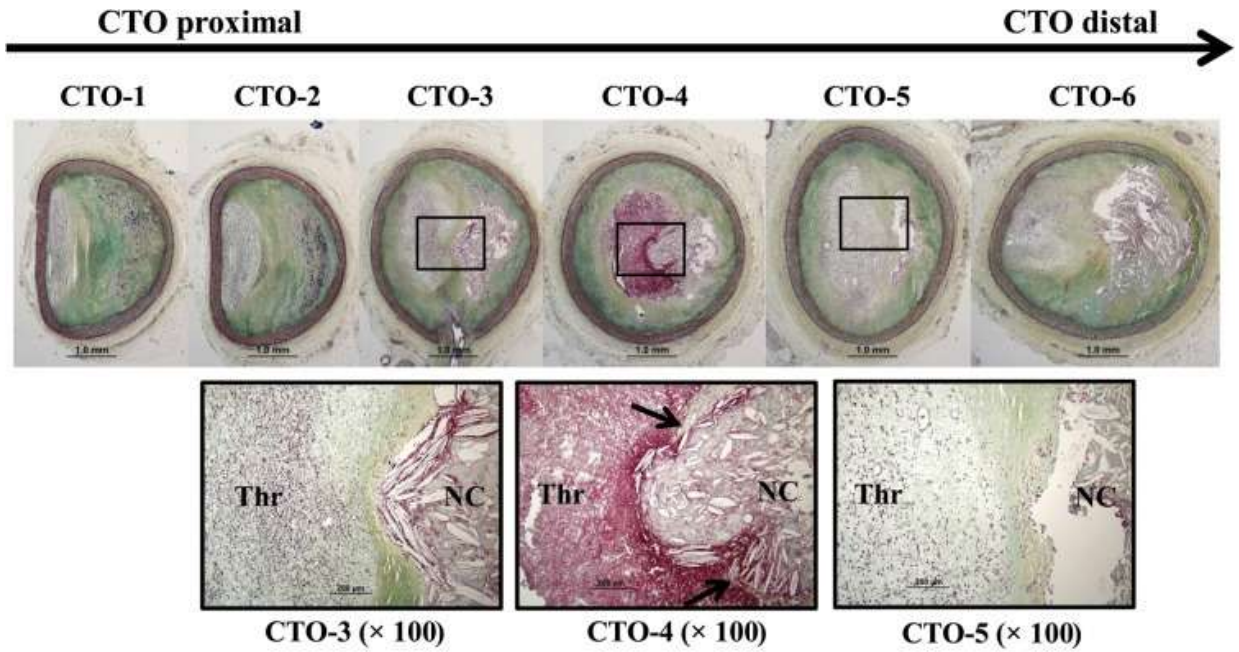
EUROCTO CLUB

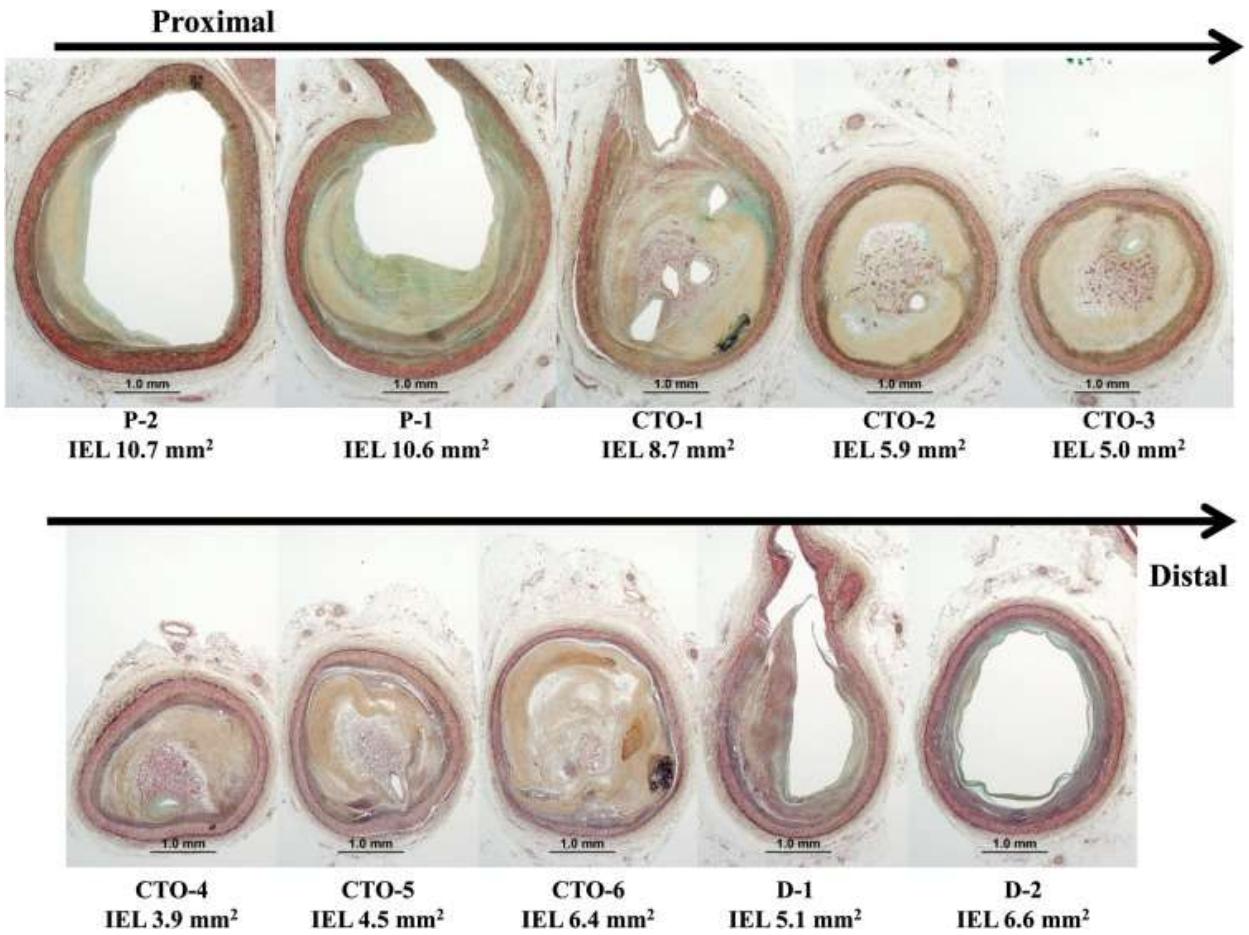


Definition

Coronary chronic total occlusions (CTOs) are defined as "coronary occlusions without antegrade flow through the lesion (TIMI [Thrombolysis In Myocardial Infarction] grade 0 flow) with a presumed or documented duration of ≥ 3 months."[1] Lesions with bridging collaterals that antegradely fill the target vessel can be classified as CTOs, as long as there is no antegrade flow through the lesion itself. Functional occlusions, defined as those with TIMI grade 1 antegrade flow through a severely stenosed but patent lumen, even if not visible on angiography, do not qualify as CTOs. In addition to TIMI grade 0 flow, the typical appearance of a CTO includes angiographically visible mature collaterals and absence of thrombus or staining at the proximal cap.

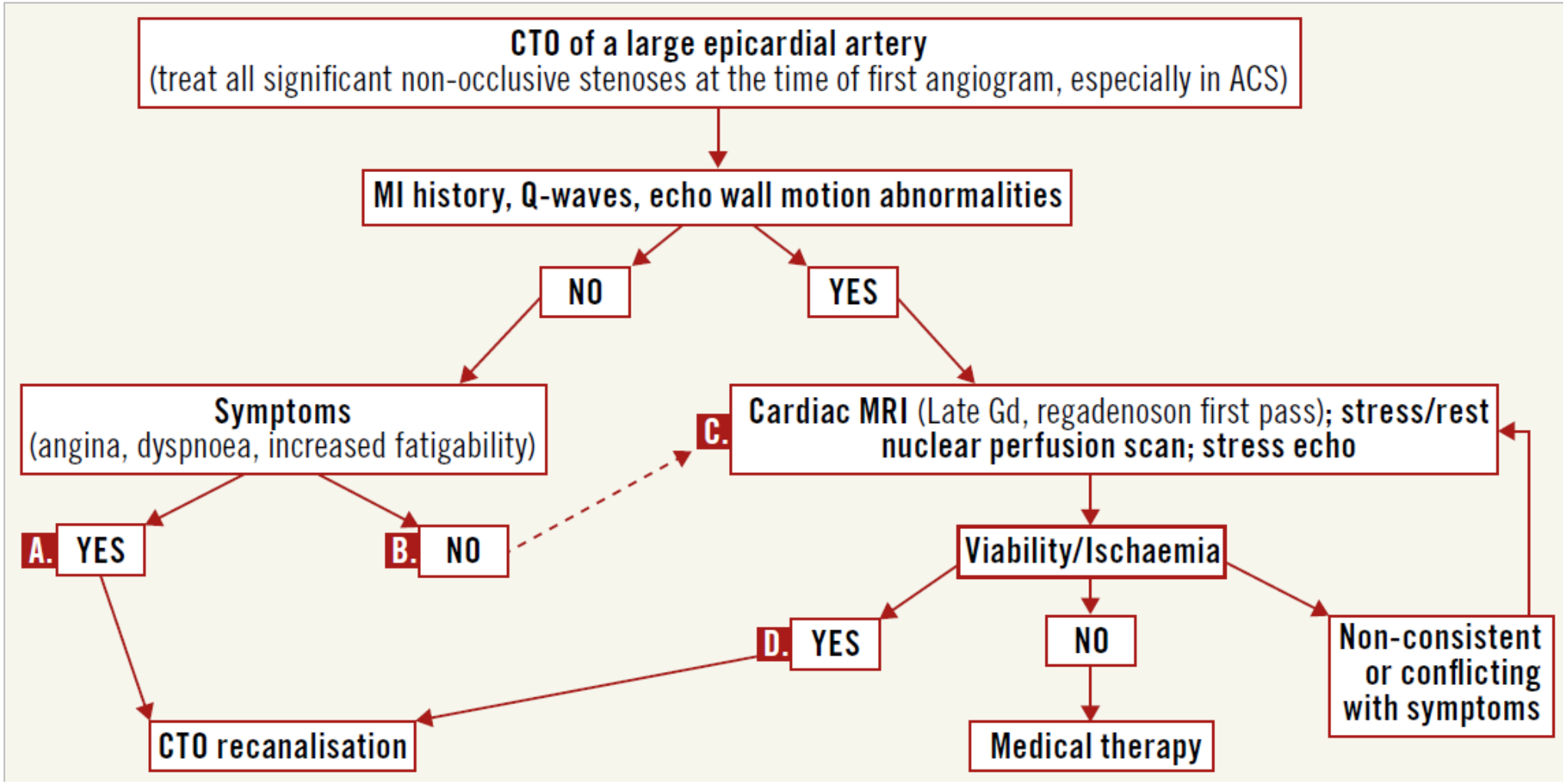
Native CTO

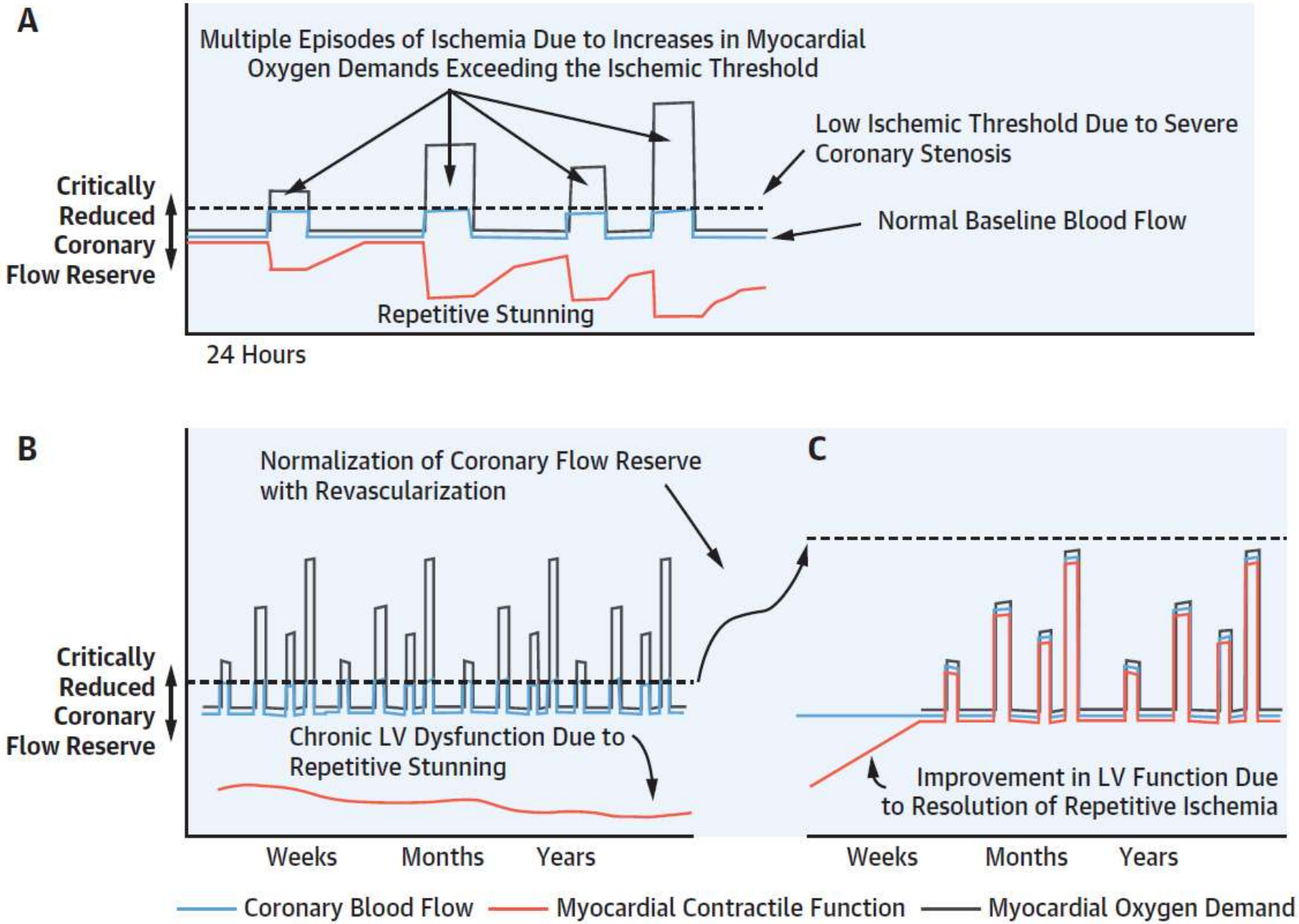




Eur Heart J. 2014 Jul 1;35(25):1683-93.

Who has to be treated?

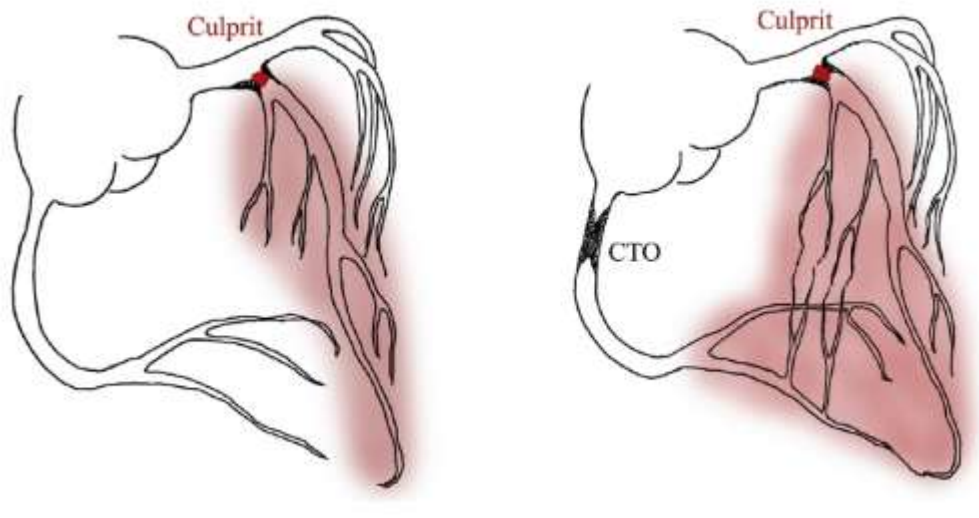


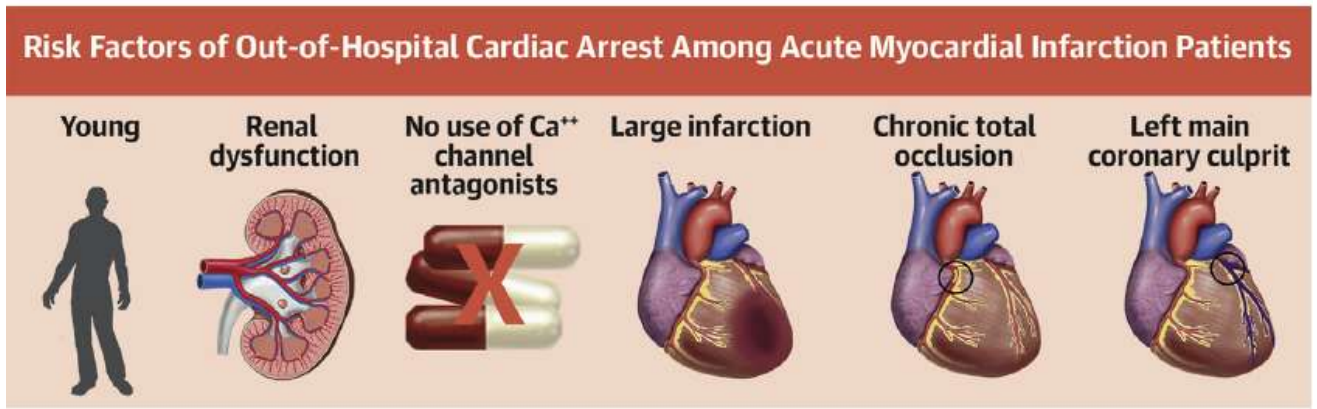

A
Multiple Episodes of Ischemia Due to Increases in Myocardial Oxygen Demands Exceeding the Ischemic Threshold
Low Ischemic Threshold Due to Severe Coronary Stenosis
Normal Baseline Blood Flow
Critically Reduced Coronary Flow Reserve
Repetitive Stunning
24 Hours
B
Normalization of Coronary Flow Reserve with Revascularization
Critically Reduced Coronary Flow Reserve
Chronic LV Dysfunction Due to Repetitive Stunning
Weeks
Months
Years
C
Improvement in LV Function Due to Resolution of Repetitive Ischemia
Weeks
Months
Years
Coronary Blood Flow
Myocardial Contractile Function
Myocardial Oxygen Demand

Survivor Bias

- I had patient with CTO he lived up to 100 !..

Clinical and Angiographic Features of Patients With Out-of-Hospital Cardiac Arrest and Acute Myocardial Infarction

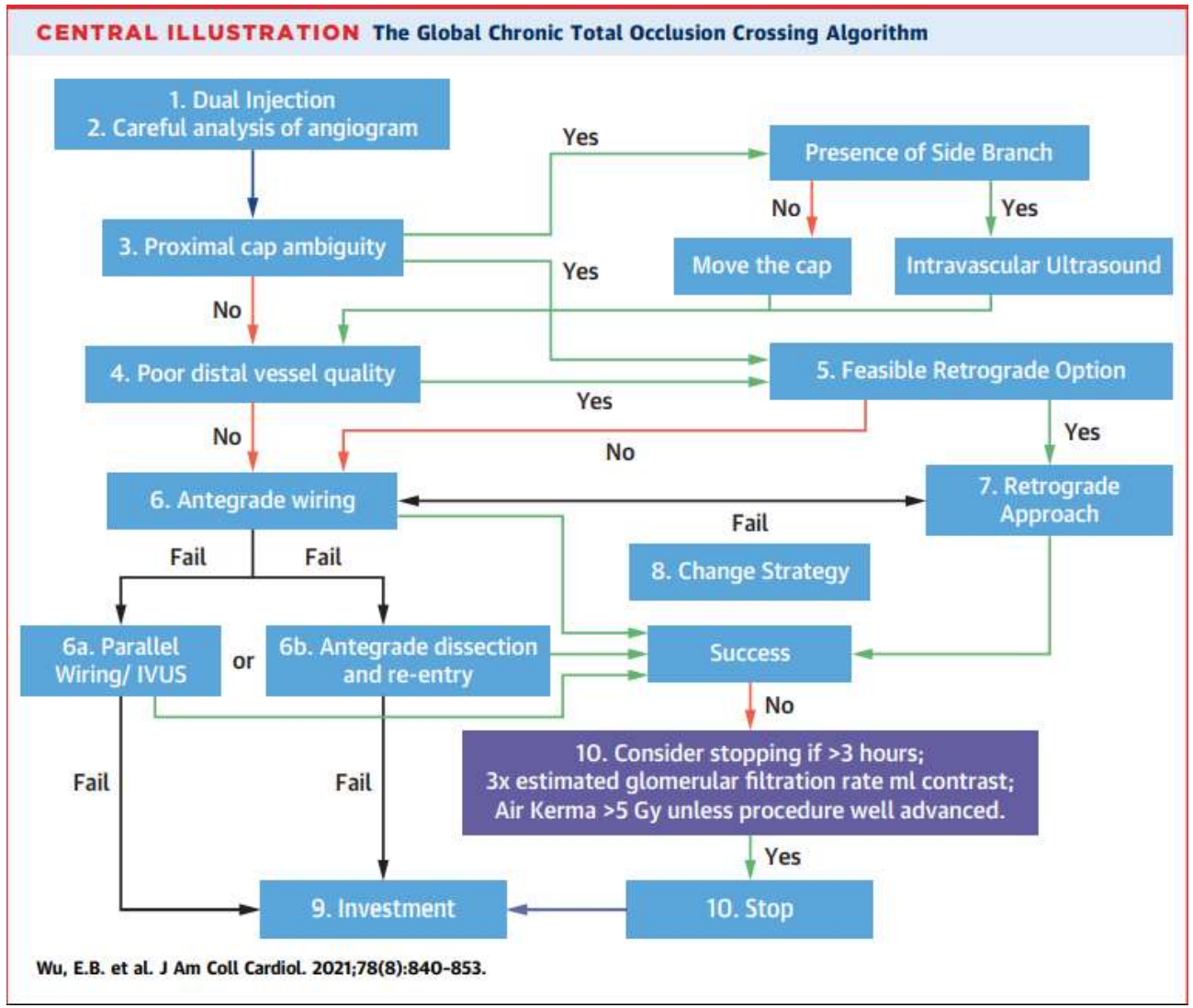




J A C C V O L . 7 6 , NO . 1 7 , 2 0 2 0 O C T O B E R 2 7 , 2 0 2 0 : 1 9 3 4 – 4 3
Kosugi et al. MI With Out-of-Hospital Cardiac Arrest

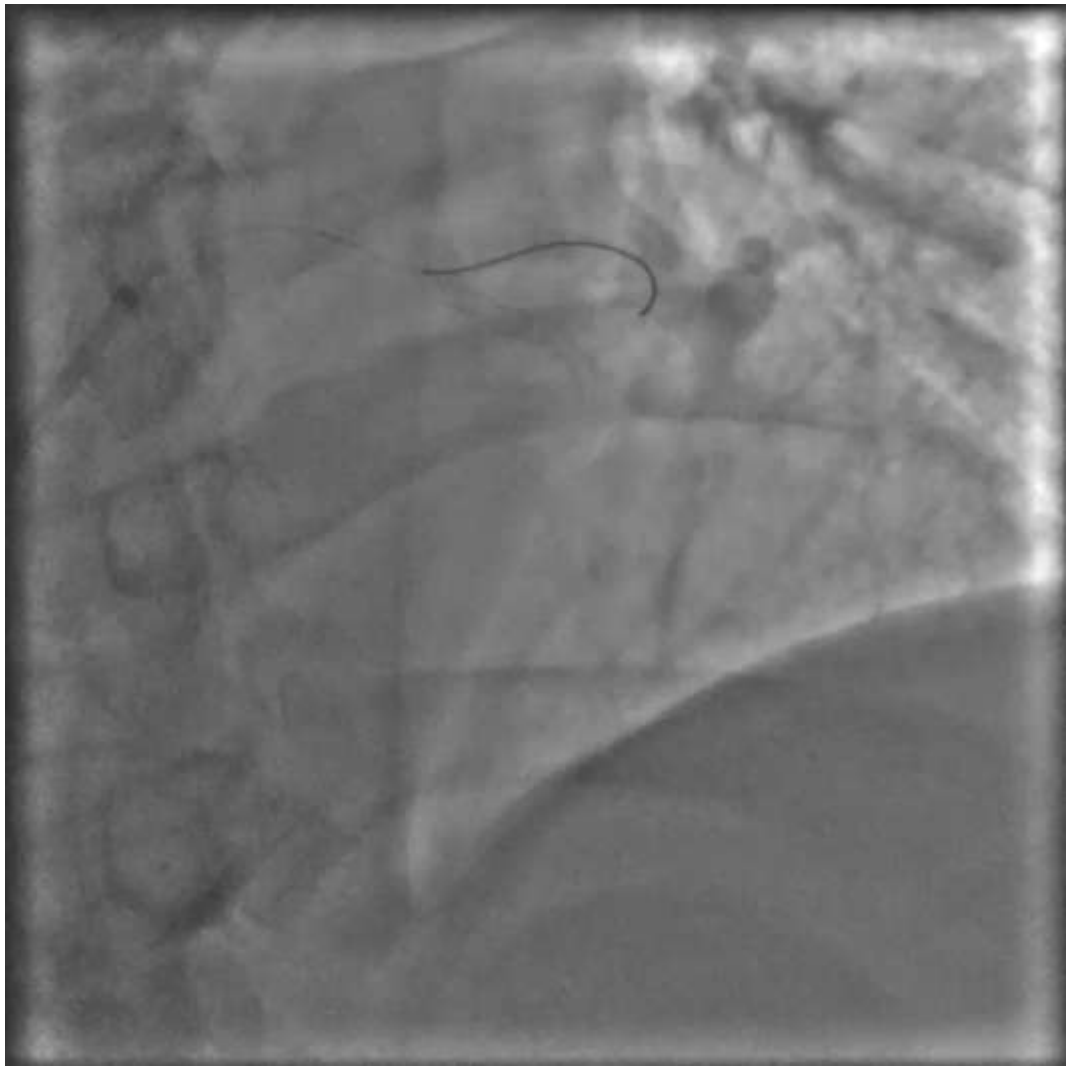
Trial/ authors	Study design and period	Number of patients	Comparators	Cohort	Endpoints	Results	Other findings and comments
Park et al[61]	Observa-tional (2003-2012)	1,547 (from a single centre in the Republic of Korea)	CTO PCI vs OMT	CTO patients with angina or silent ischaemia	Primary: cardiac death at 10 years. Secondary: all-cause death, acute MI and any revascularisa-tion at 10 years.	Primary and secondary endpoints significantly lower in PCI group, also after propensity score matching.	Cardiac death and all-cause death significantly lower in successful vs failed CTO PCI. No difference in cardiac death and all-cause death in failed PCI vs OMT.

Global Chronic Total Occlusion Crossing Algorithm

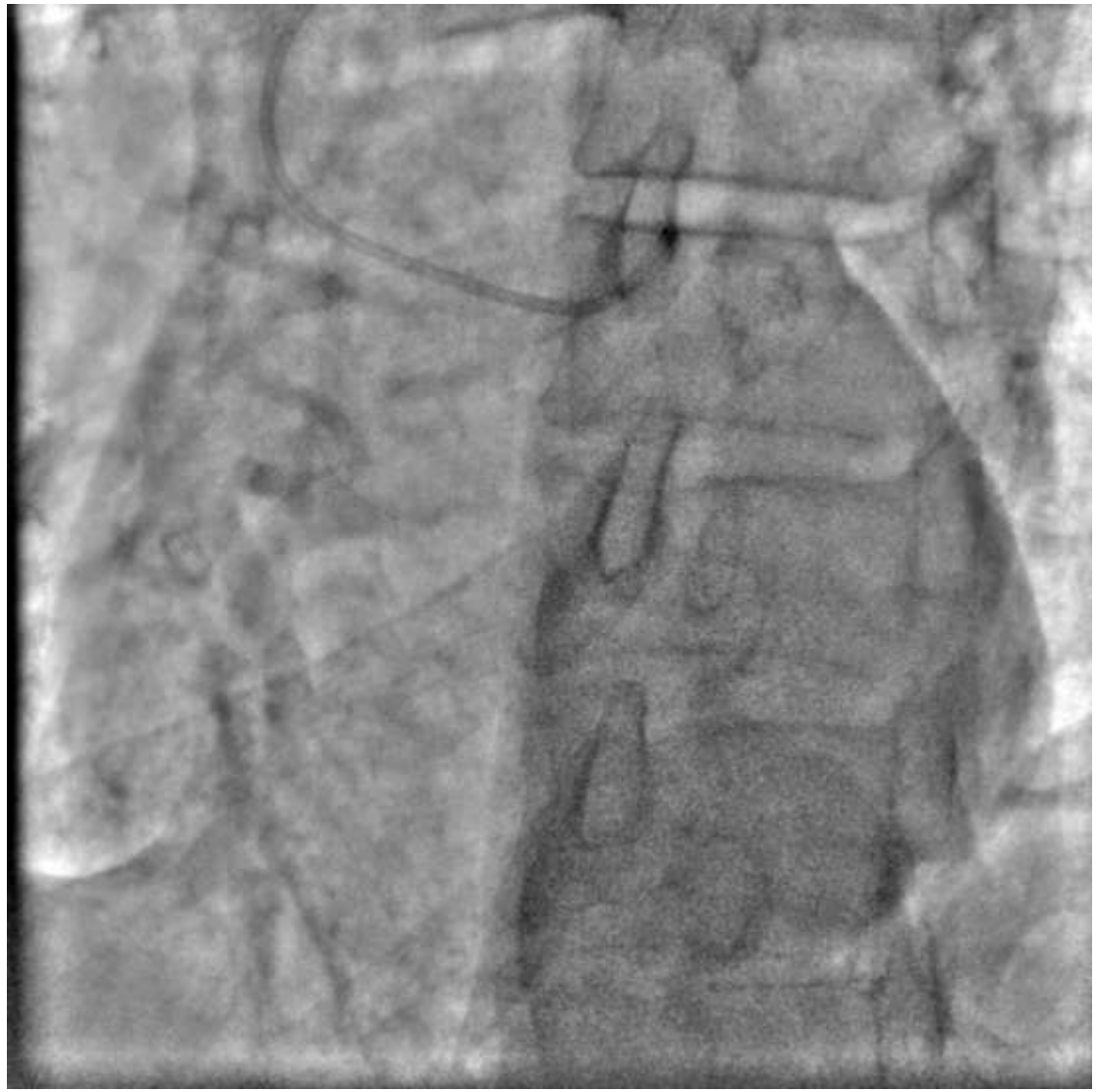


Dual injection (1) and thorough analysis (2)

- Occlusion length
- Proximal and distal caps
- Interventional collaterals



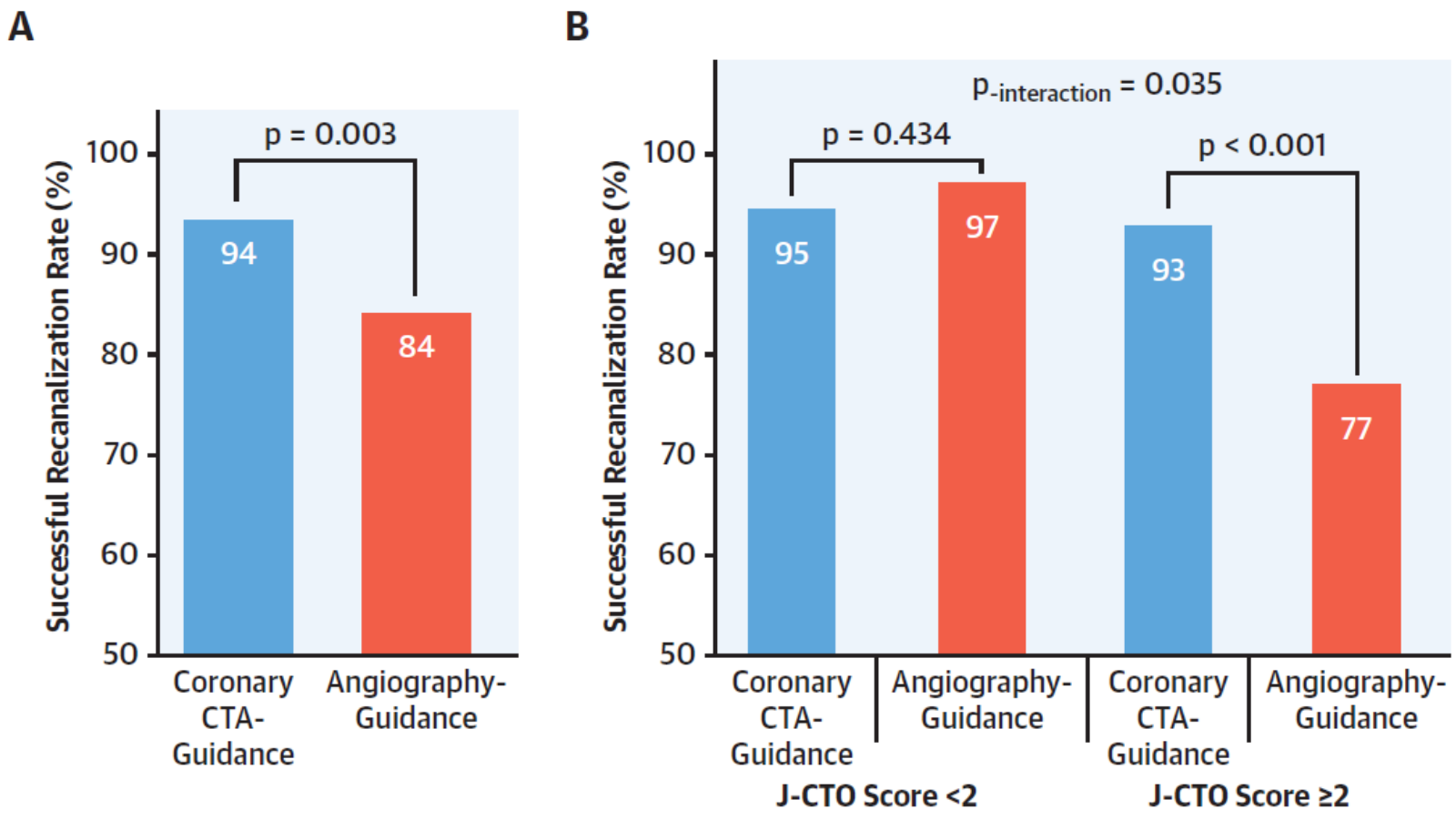
RCA CTO with ambiguous proximal cap (3), poor distal bed (4) inappropriate interventional collaterals (5)



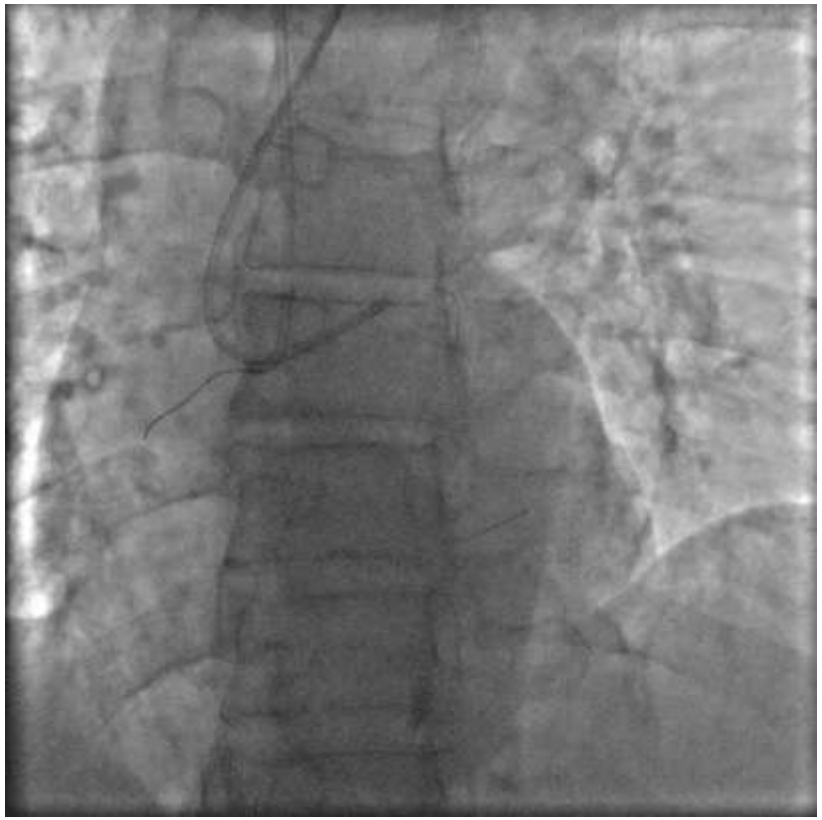
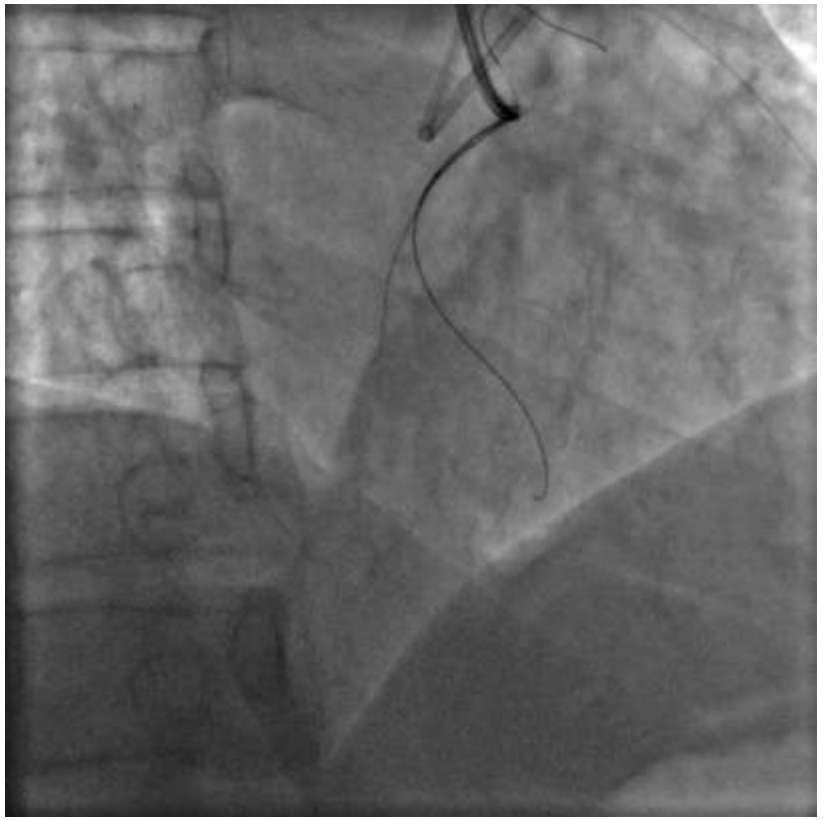
CTA - guidance

Effect of Coronary CTA on Chronic Total Occlusion Percutaneous Coronary Intervention

CENTRAL ILLUSTRATION **Comparison of the Rates of Successful Revascularization and 1-Year Major Adverse Cardiac Events**



Final Ressult


Start antegrade (6)

- In case of the presence of the proximal stump
  - Use side branch for anchoring and/or IVUS
  - Guiding catheter 7Fr
- In-Stent Occlusion
- xCART
- ADR
  - Knuckle
  - Stingray
  - IVUS

Patient B. 74 yo, m

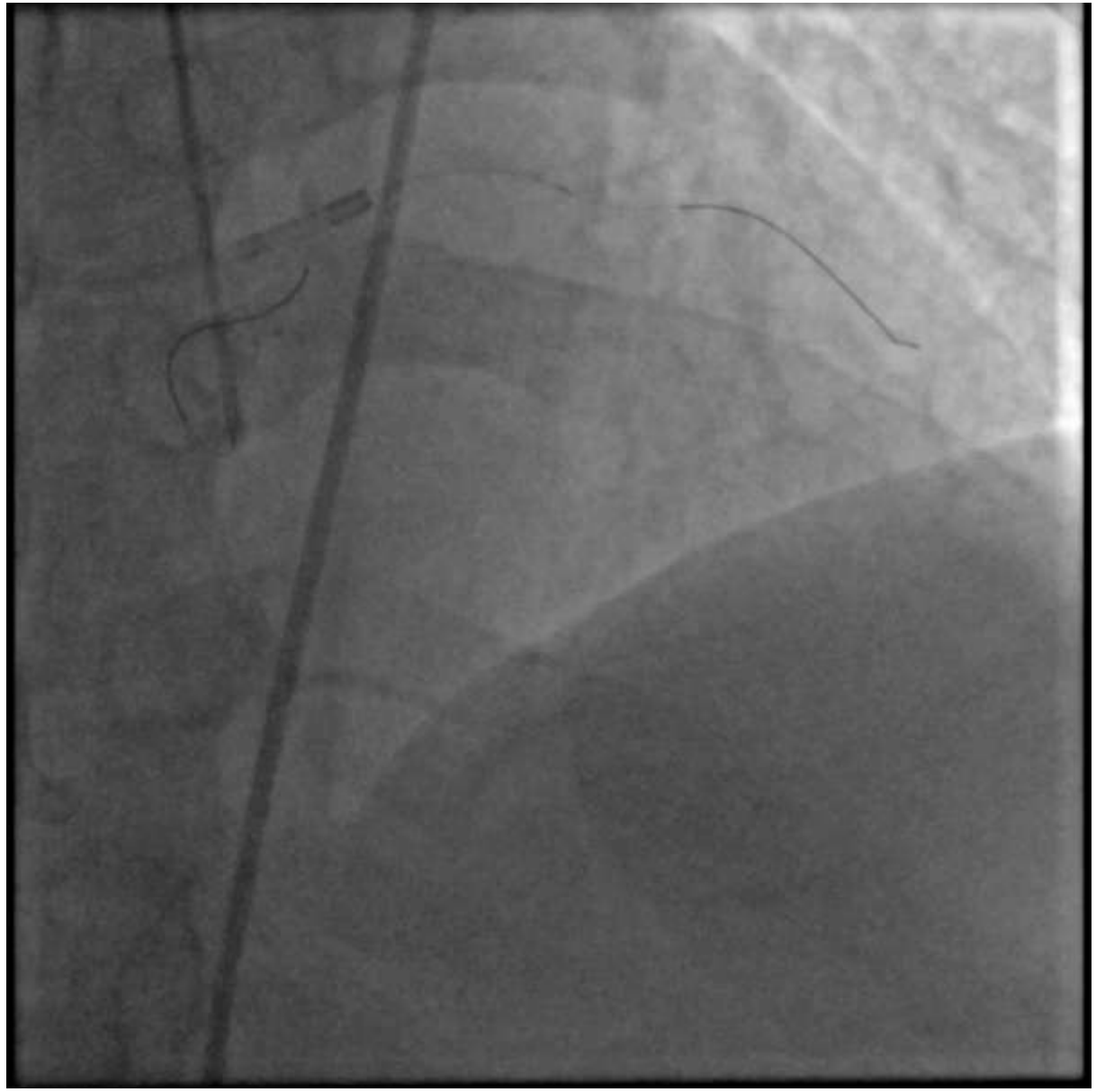
- Mild angina
- LAD PCI
  - Interventional collaterals are covered with the stent
- Previous antegrade attempt of RCA CTO treatment
- Referred to the retrograde attempt

Side branch anchor, Mamba Flex + Judo 3, Final resalt

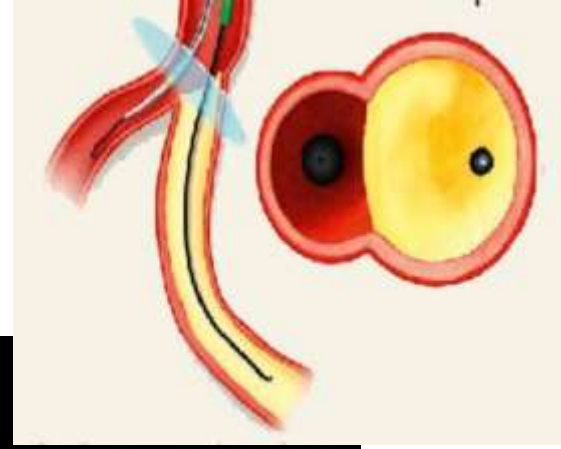


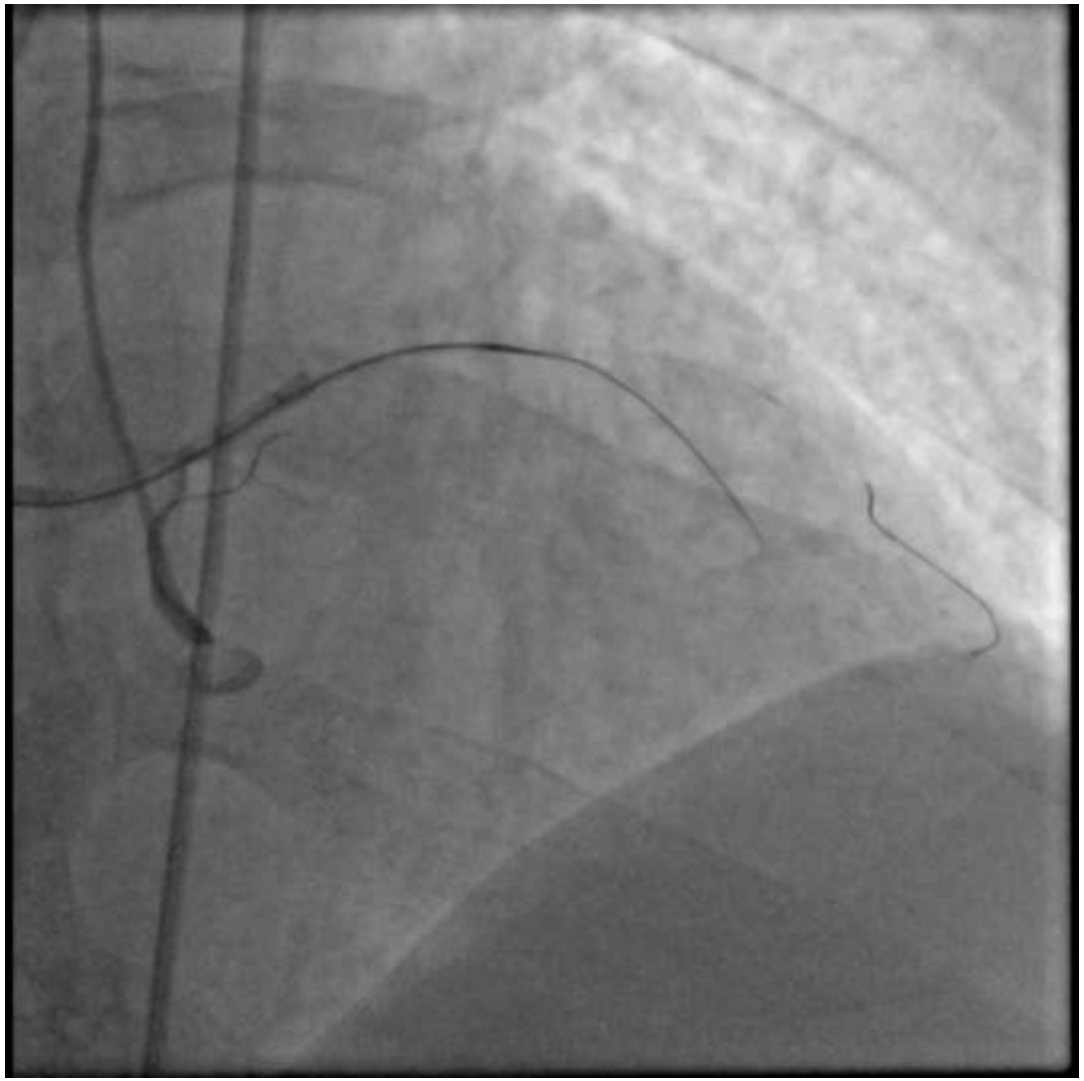
Patient S. 73 yo, m

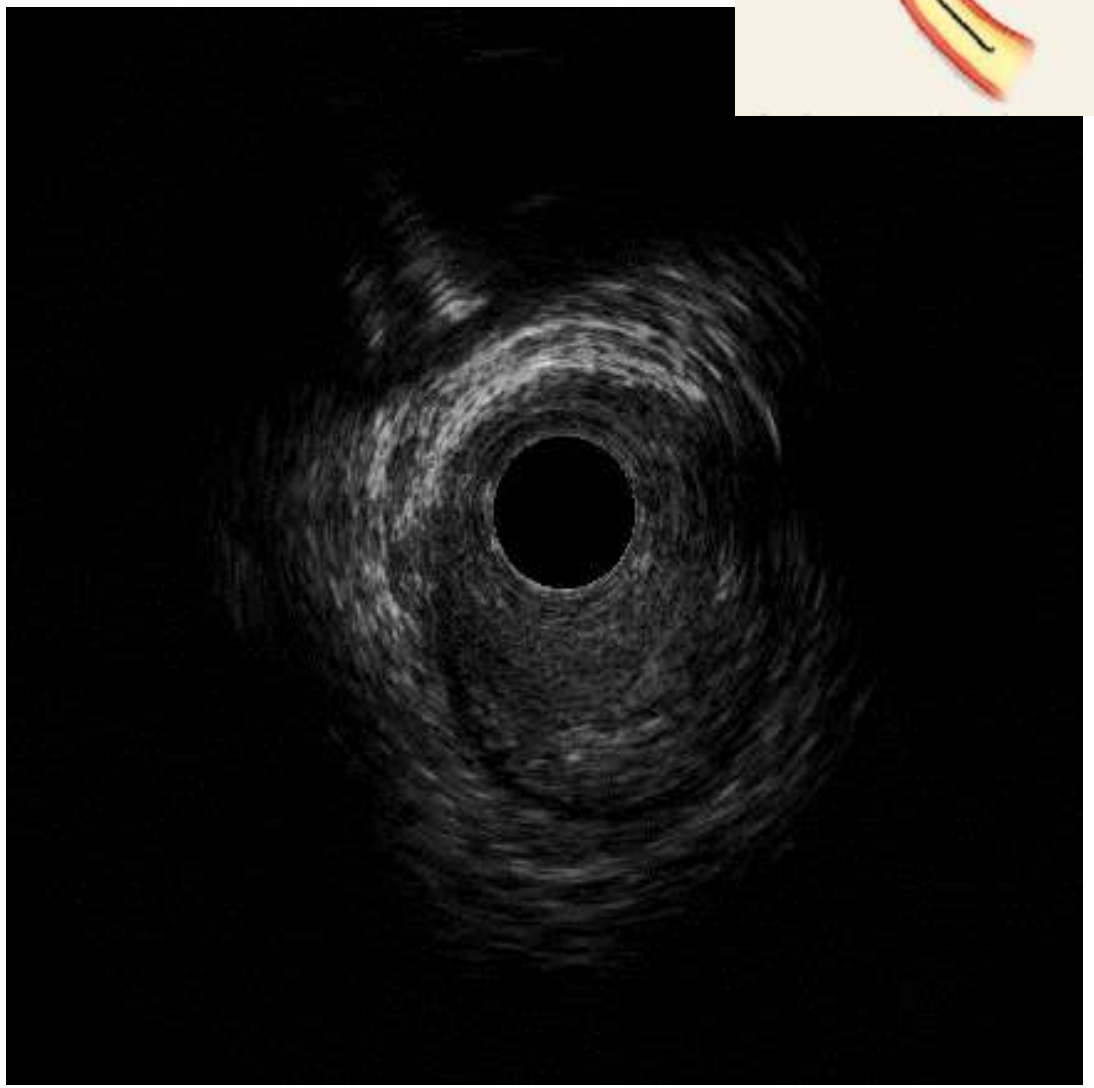
- Mild angina
- RCA PCI
- Short LAD occlusion
  - Ambiguous proximal cap
  - Relevant side branch
  - Non-interventional collaterals



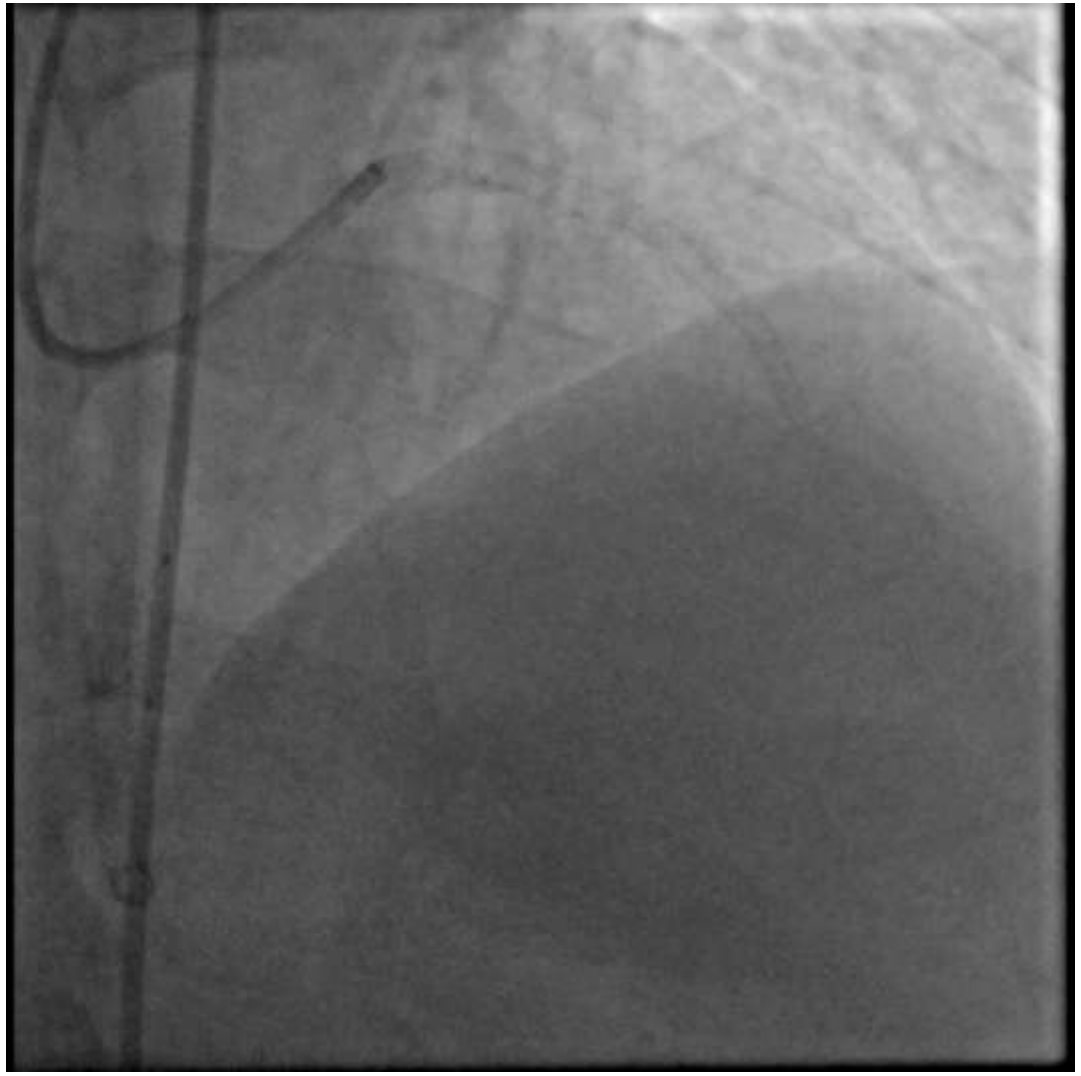
IVUS-guided proximal cap puncture (6a)
OptiCross HD 60 MHz



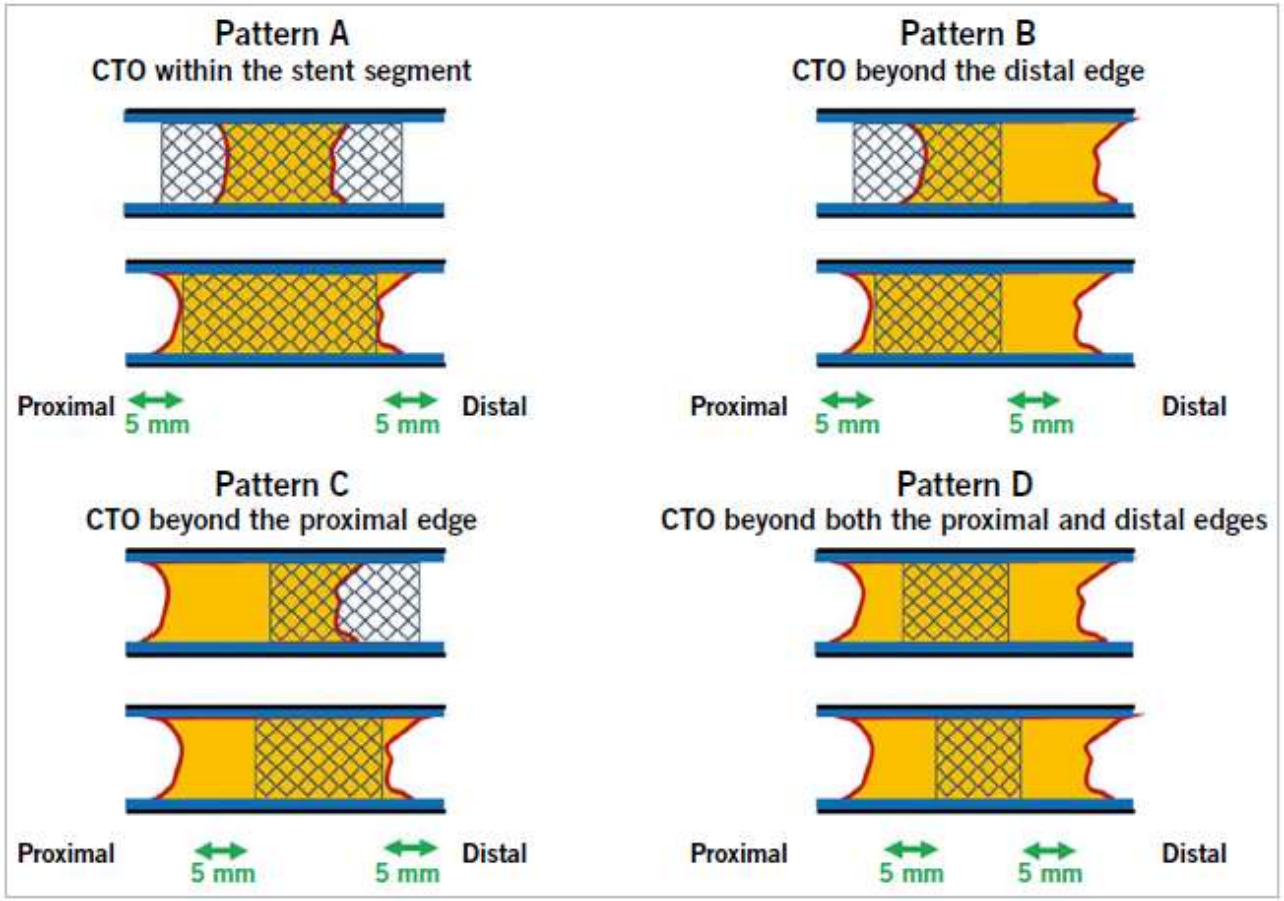


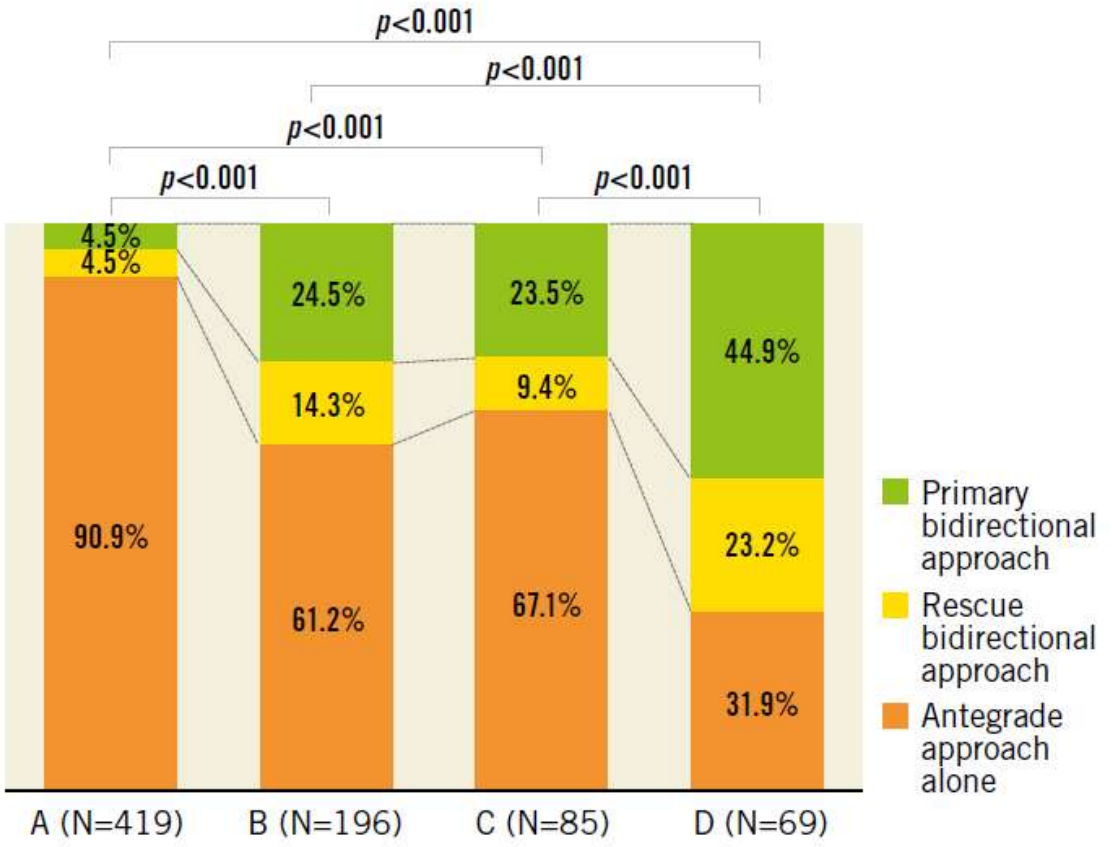


Final Result



In-stent CTO's

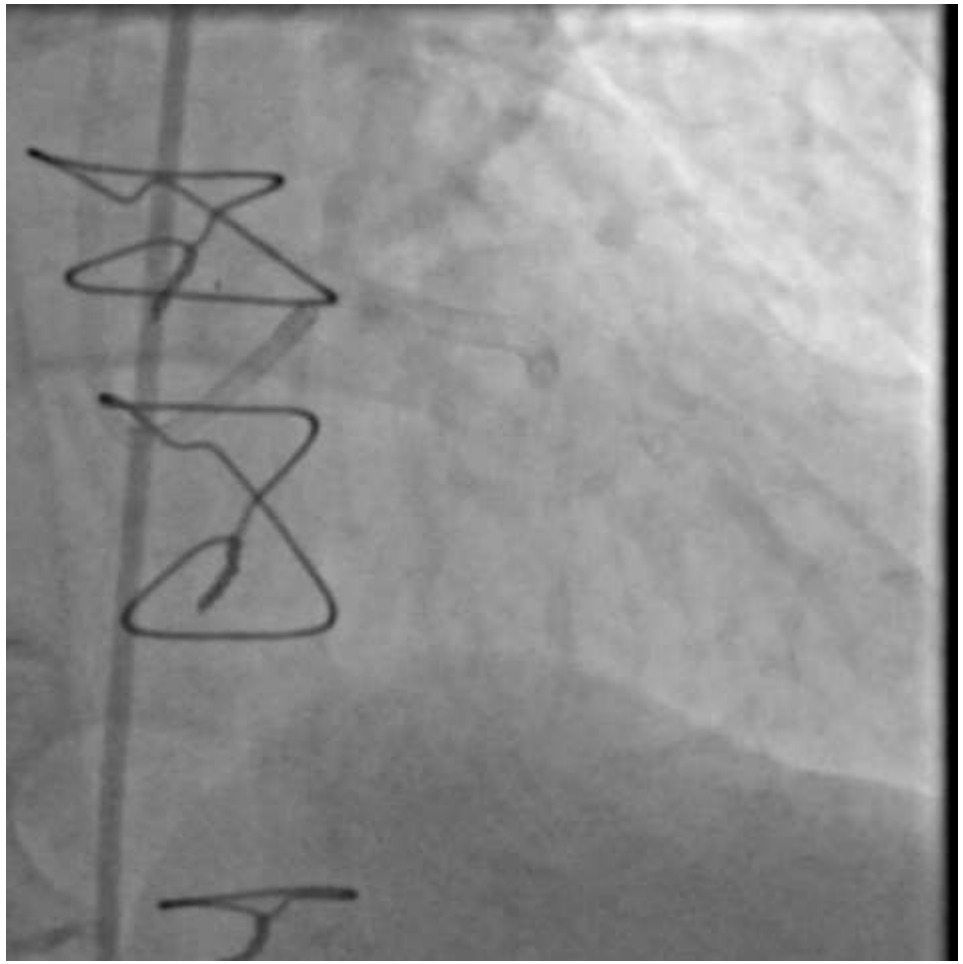


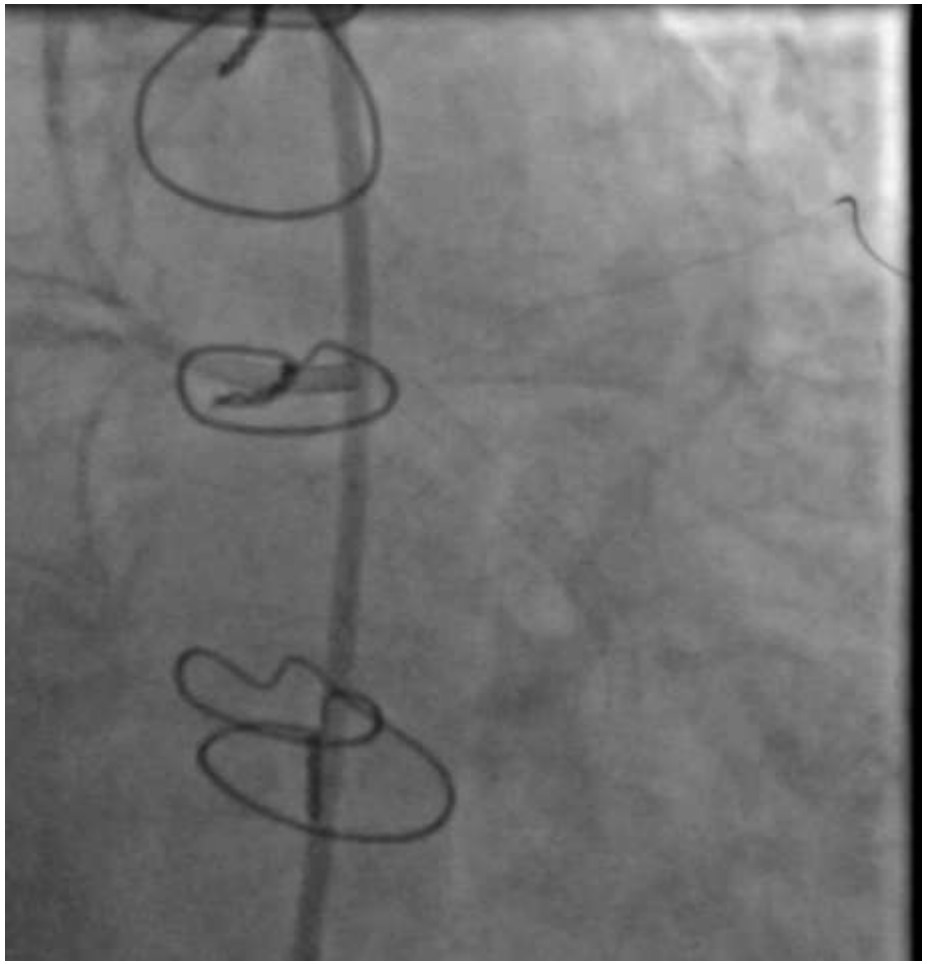


EuroIntervention 2021;17:e631-e638

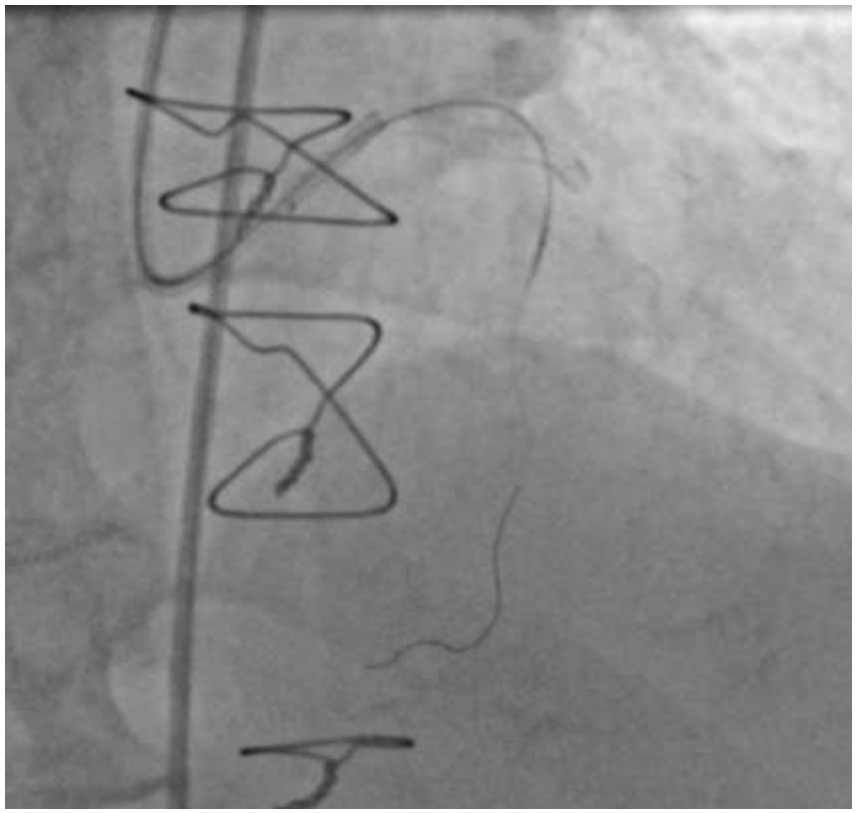
Patient S. 63 yo, female, CABG in 2013

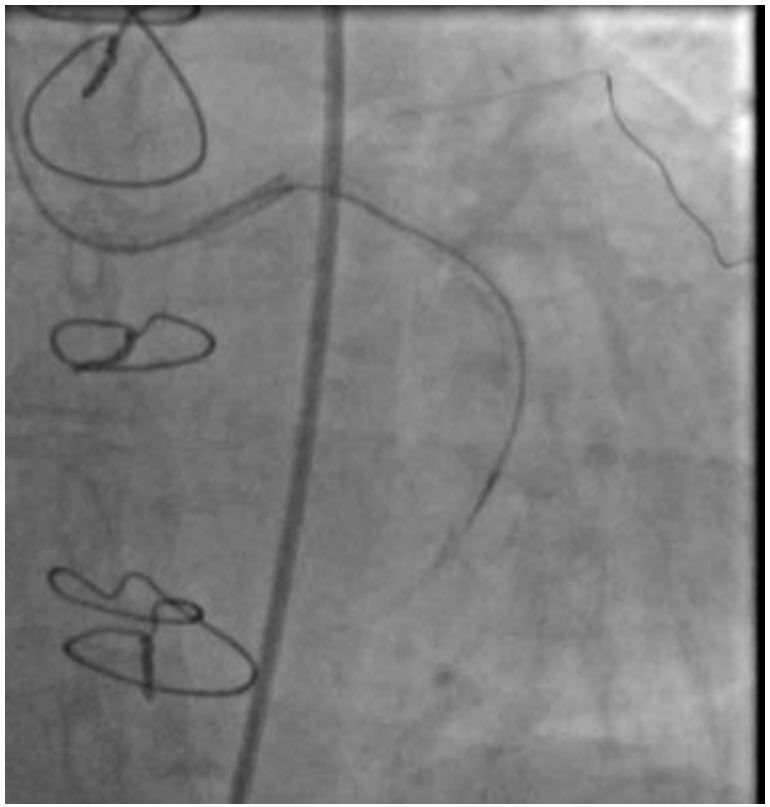
- Severe-mild angina
- SVGs to RCA and MB - occluded, LIMA-LAD - patent
- DES to IMB and Cx in 2018, previous attempt - Cx in-stent CTO



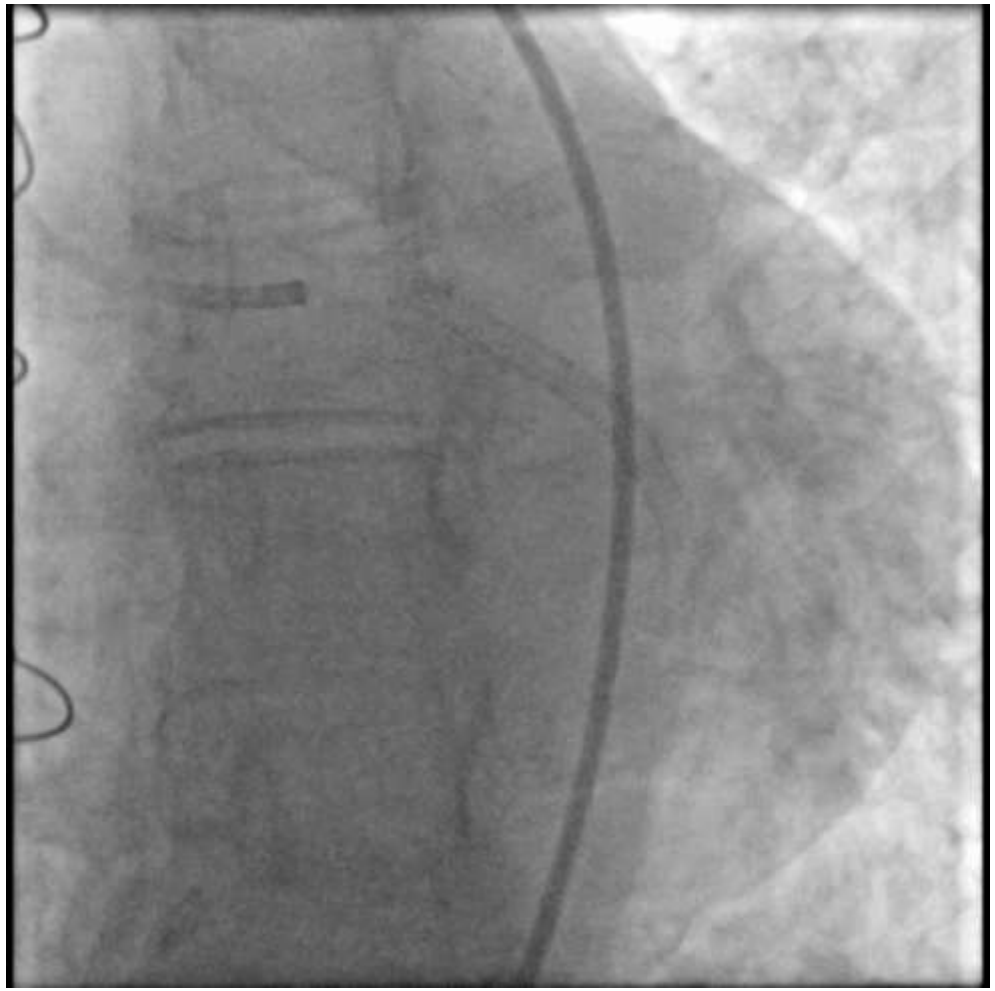


- Initial retrograde access - failed (8)
- Switch to antegrade (7 → 6) AWE (Conq Pro → Fighter knuckle)



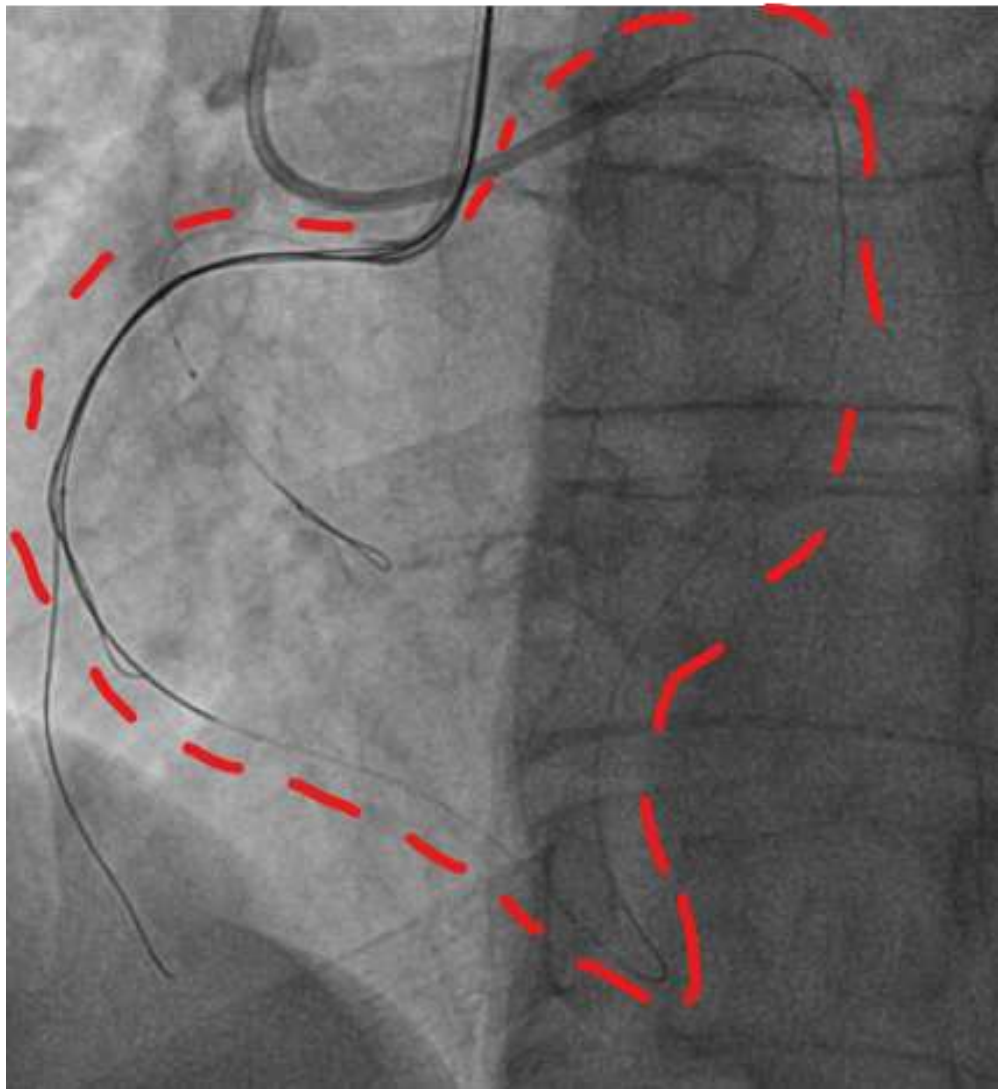


Final Result



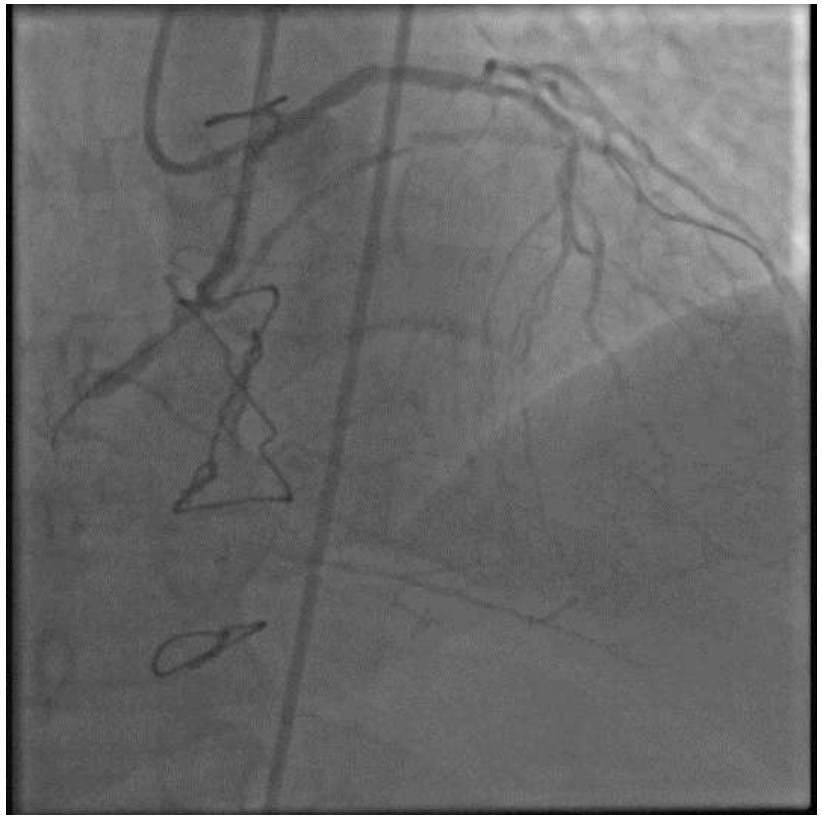
Everybody likes retro- (7)

- Во время накопления опыта все хотят, чтобы была ретроградная реканализация

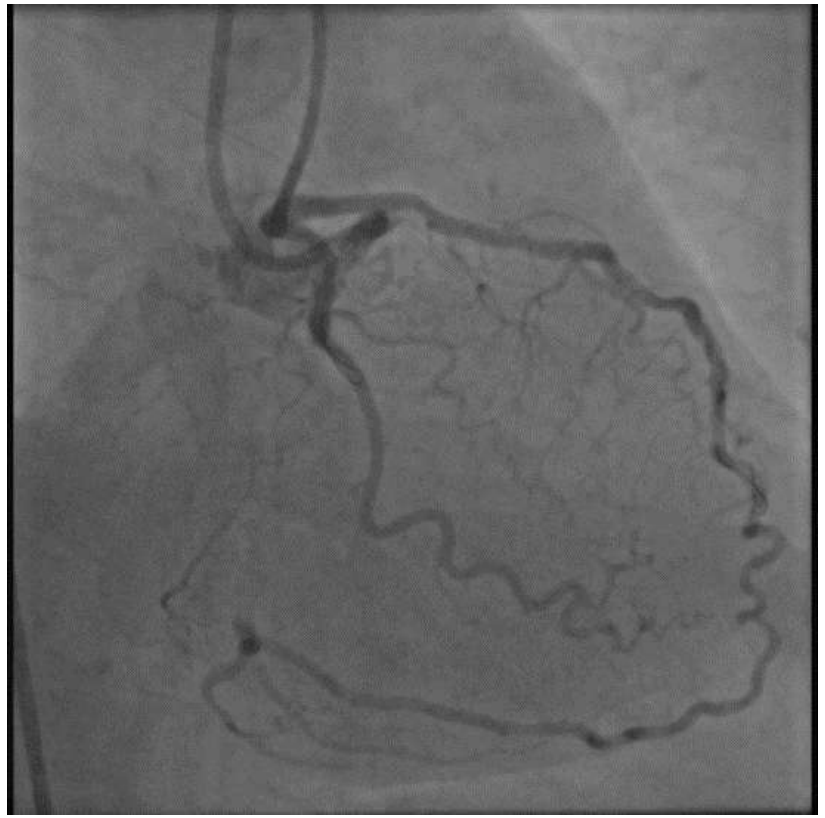


Types of collaterals

Septal



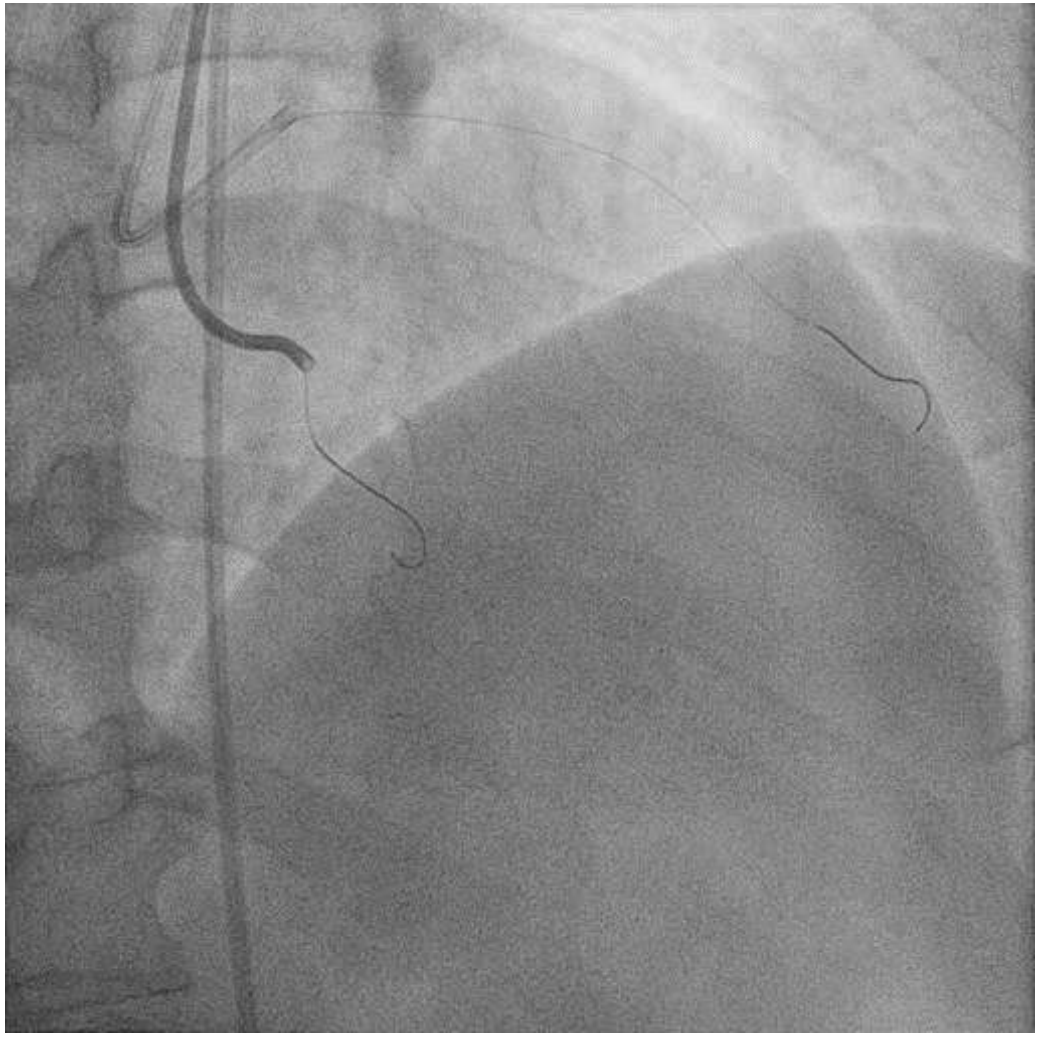
Non-septal



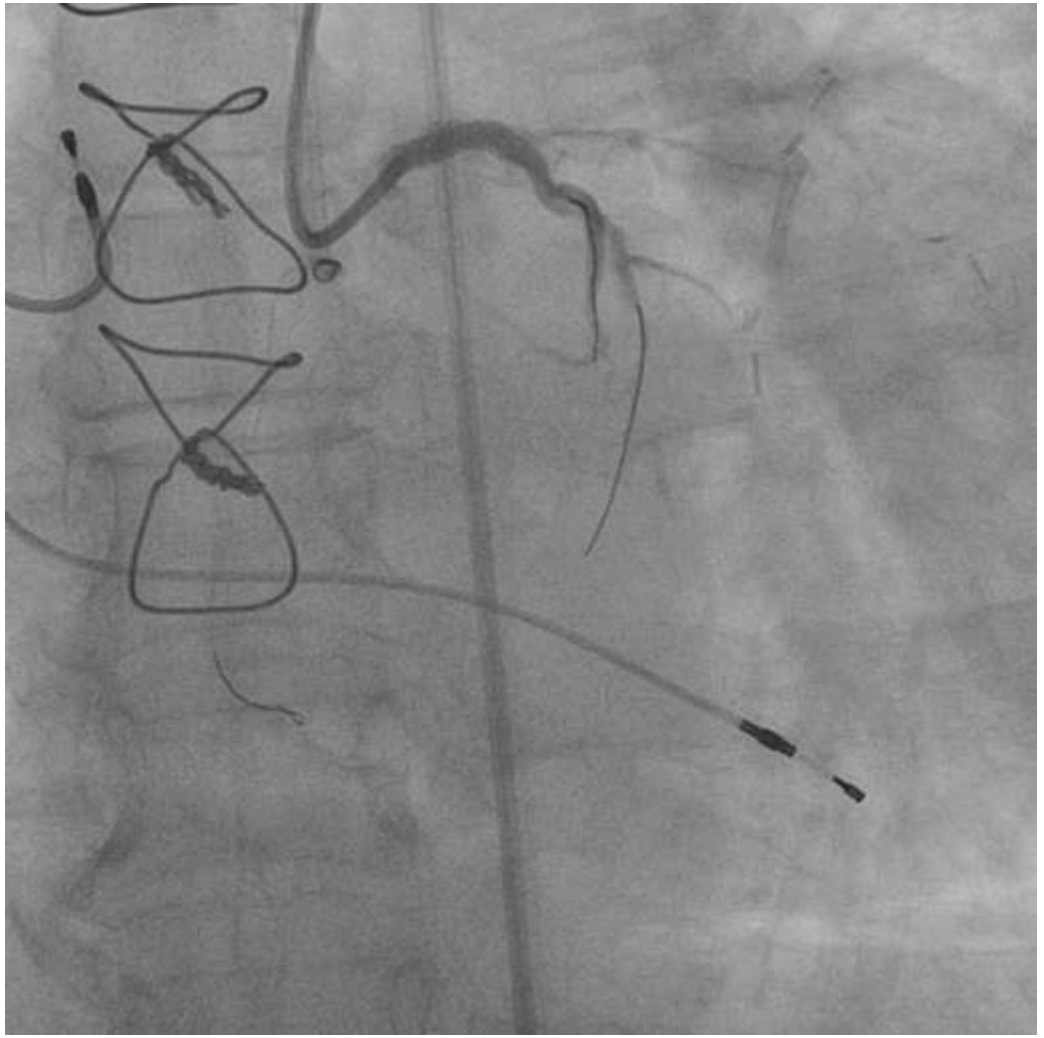
If septal and epicardial collaterals coexist, the septal pathway should be preferred because it is less prone to catastrophic perforations

Non-septal

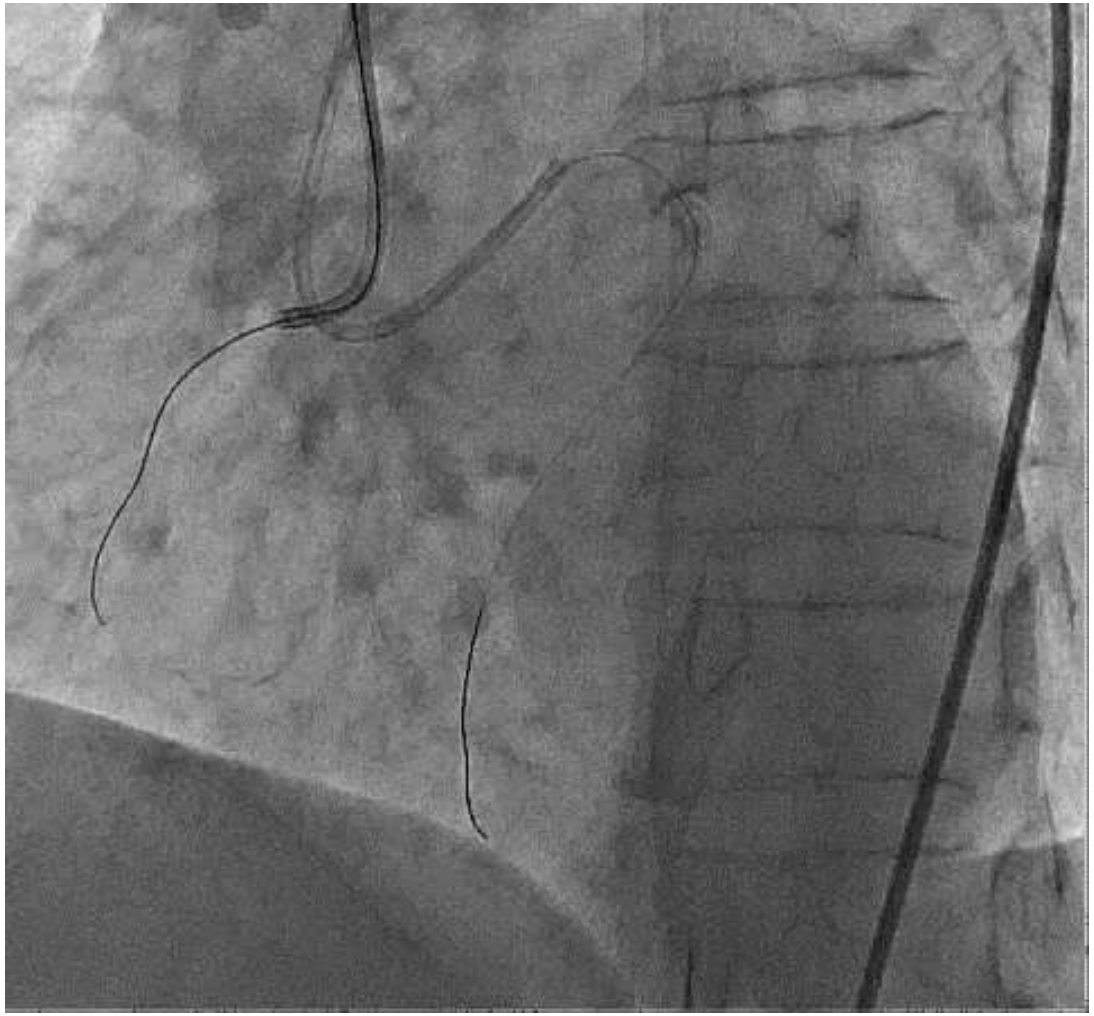
Epicardial



Atrio-ventricular groove (AVG)

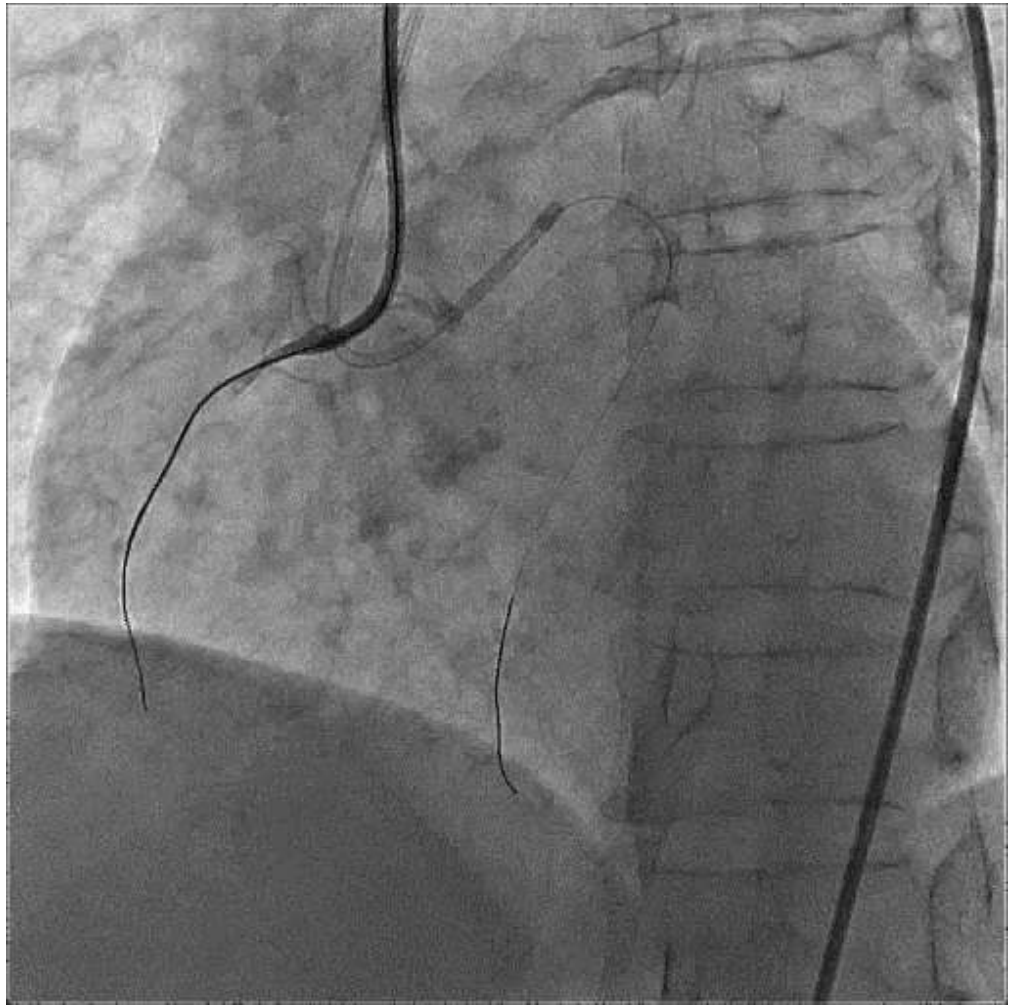


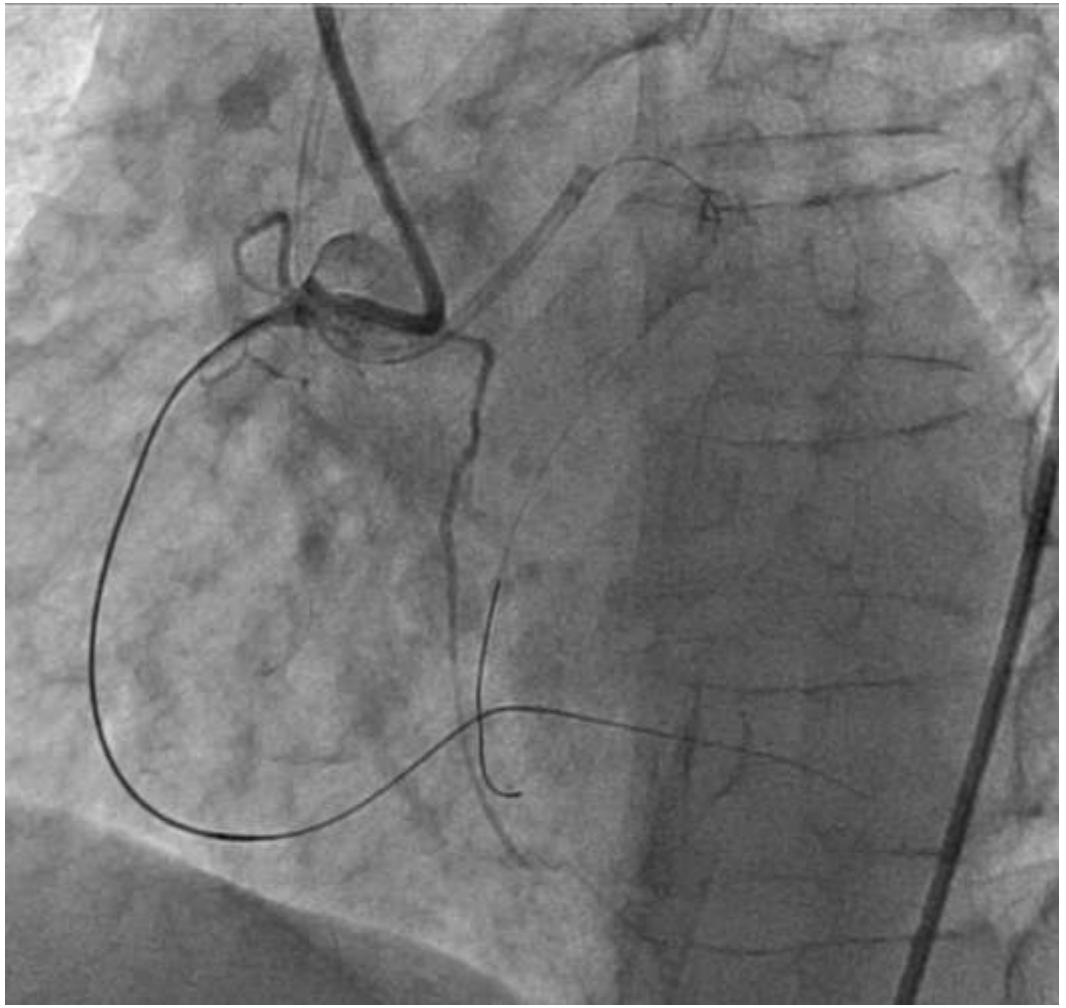
Patient B. 67 yo, f



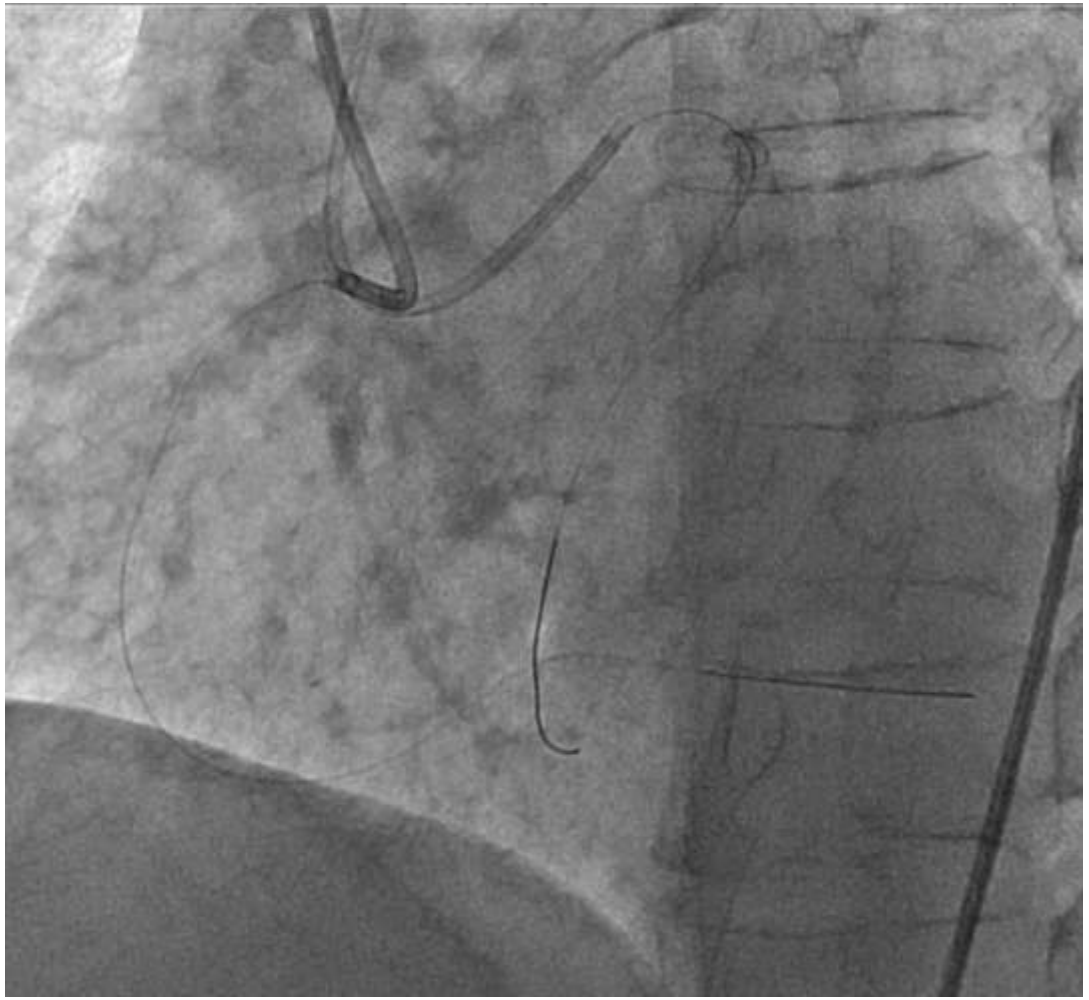
- Mild angina
- LAD PCI
- LVEF - 40%
- Previous attempt - RCA CTO

Antegrade attempt (6)

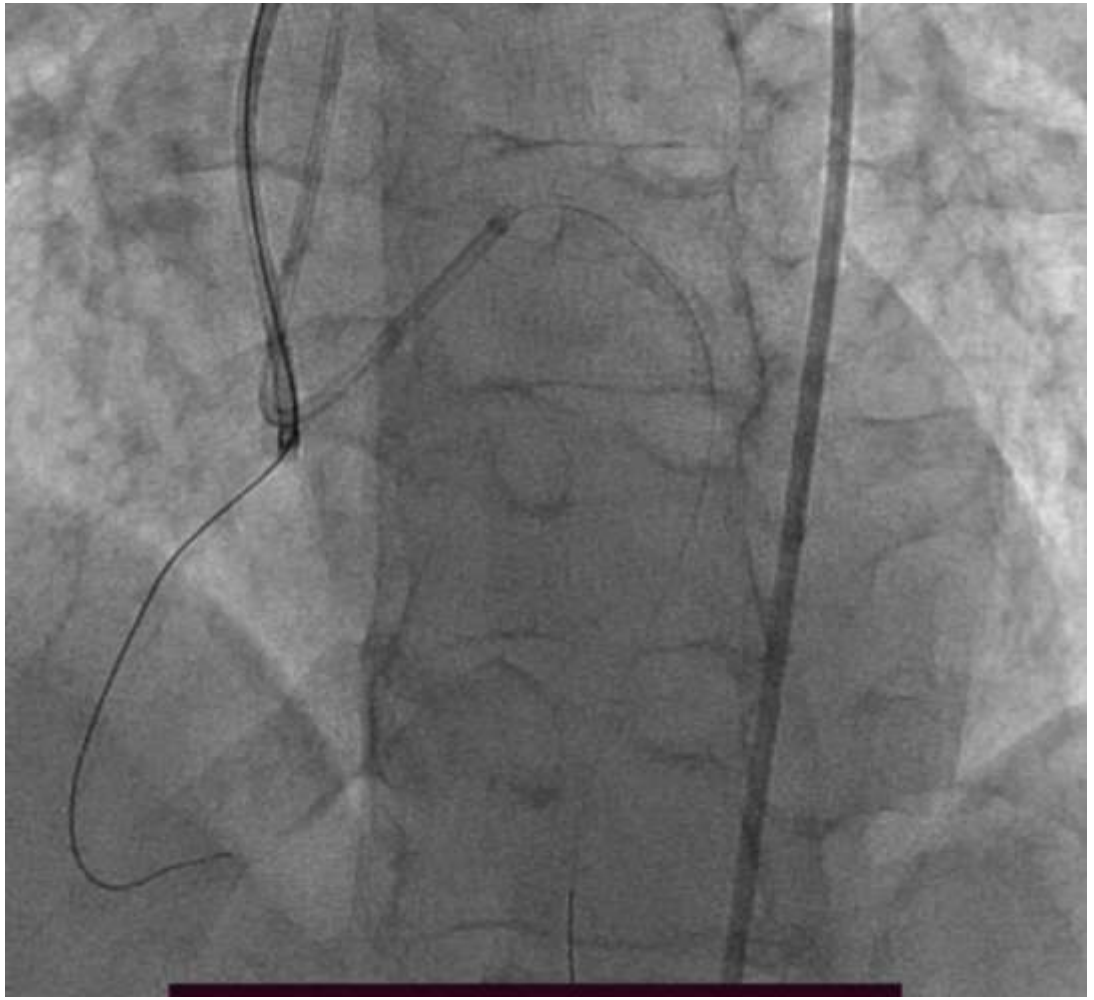




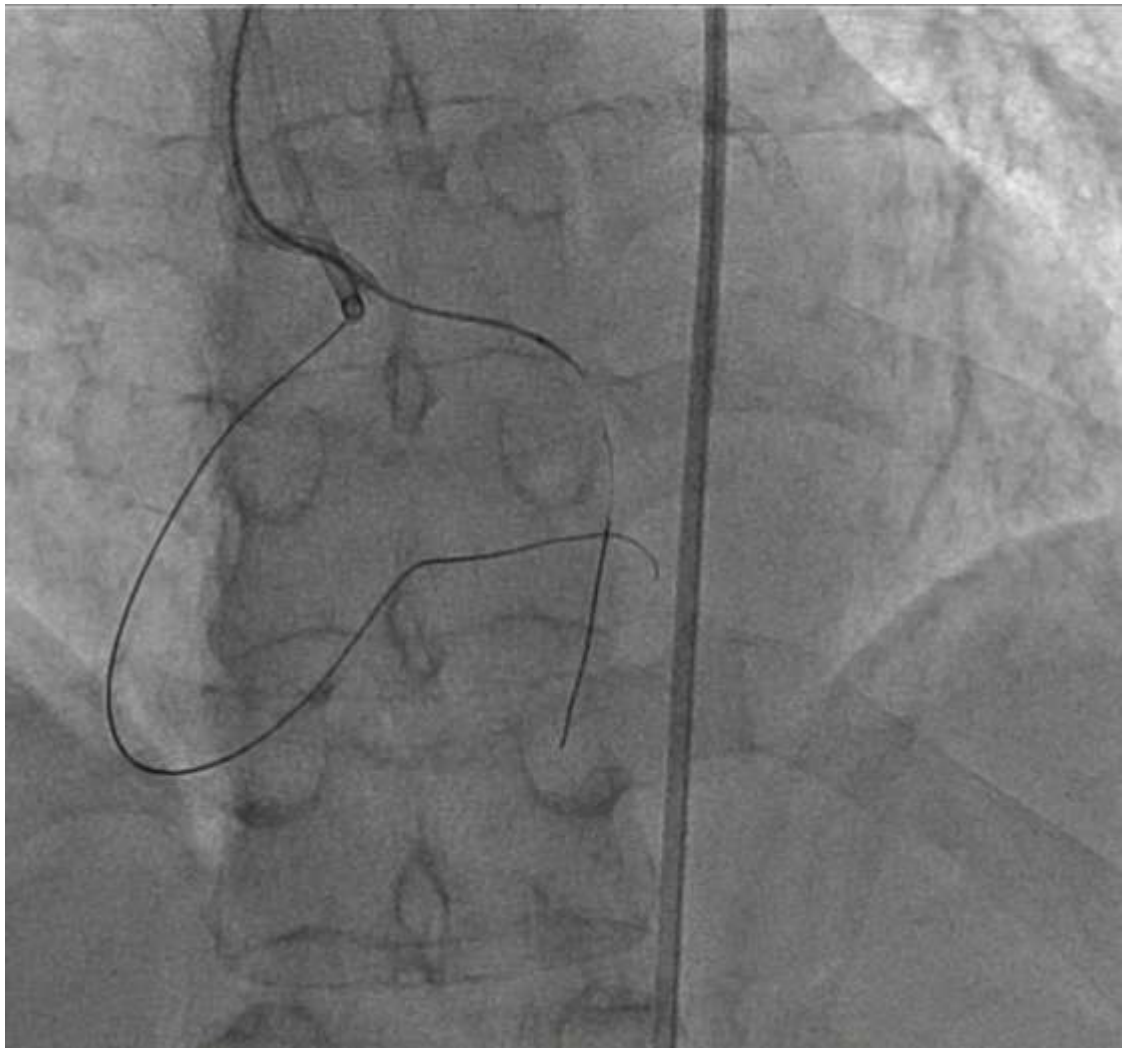
Eeeeeasy!!!

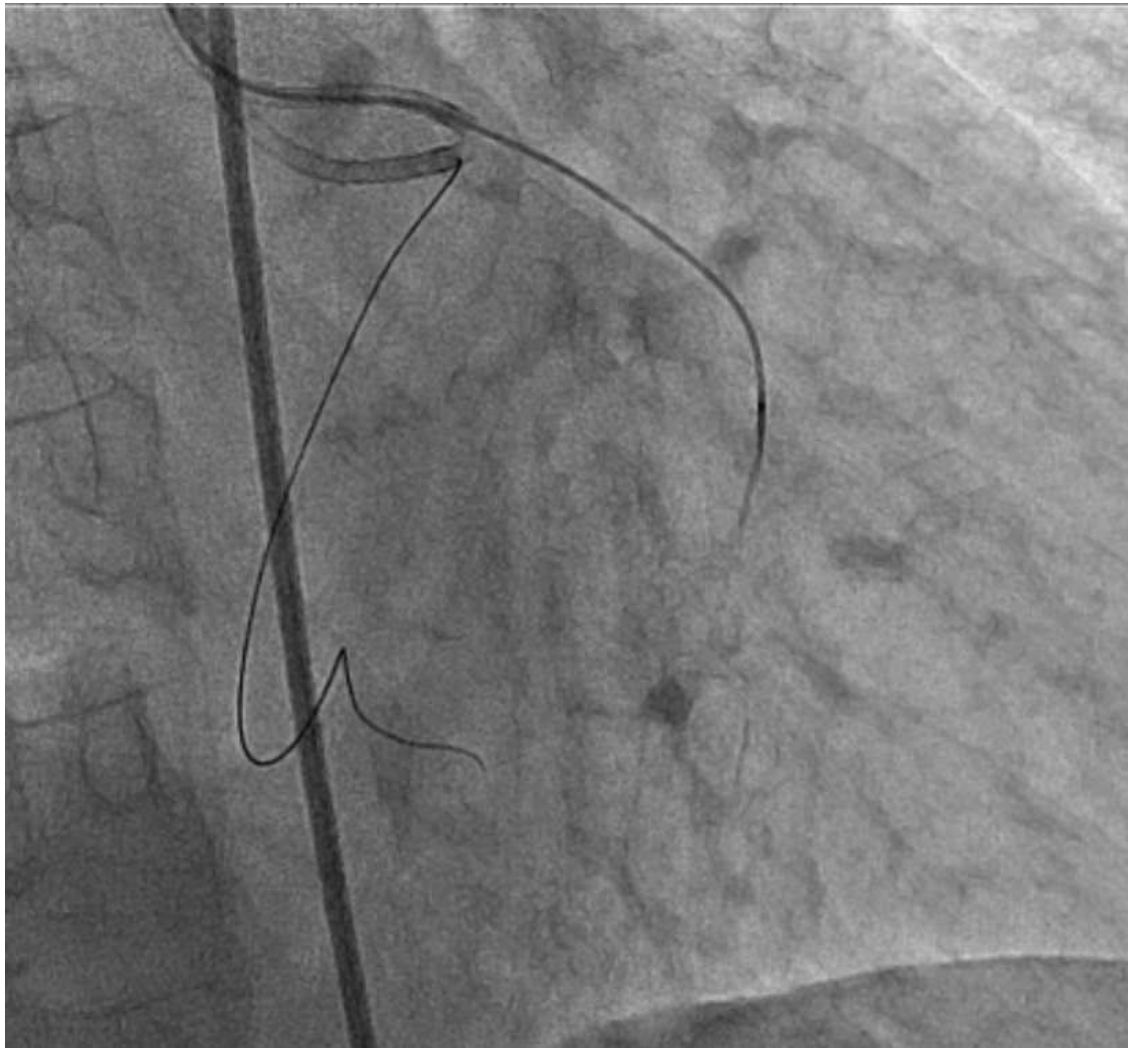


Ooooooups!..

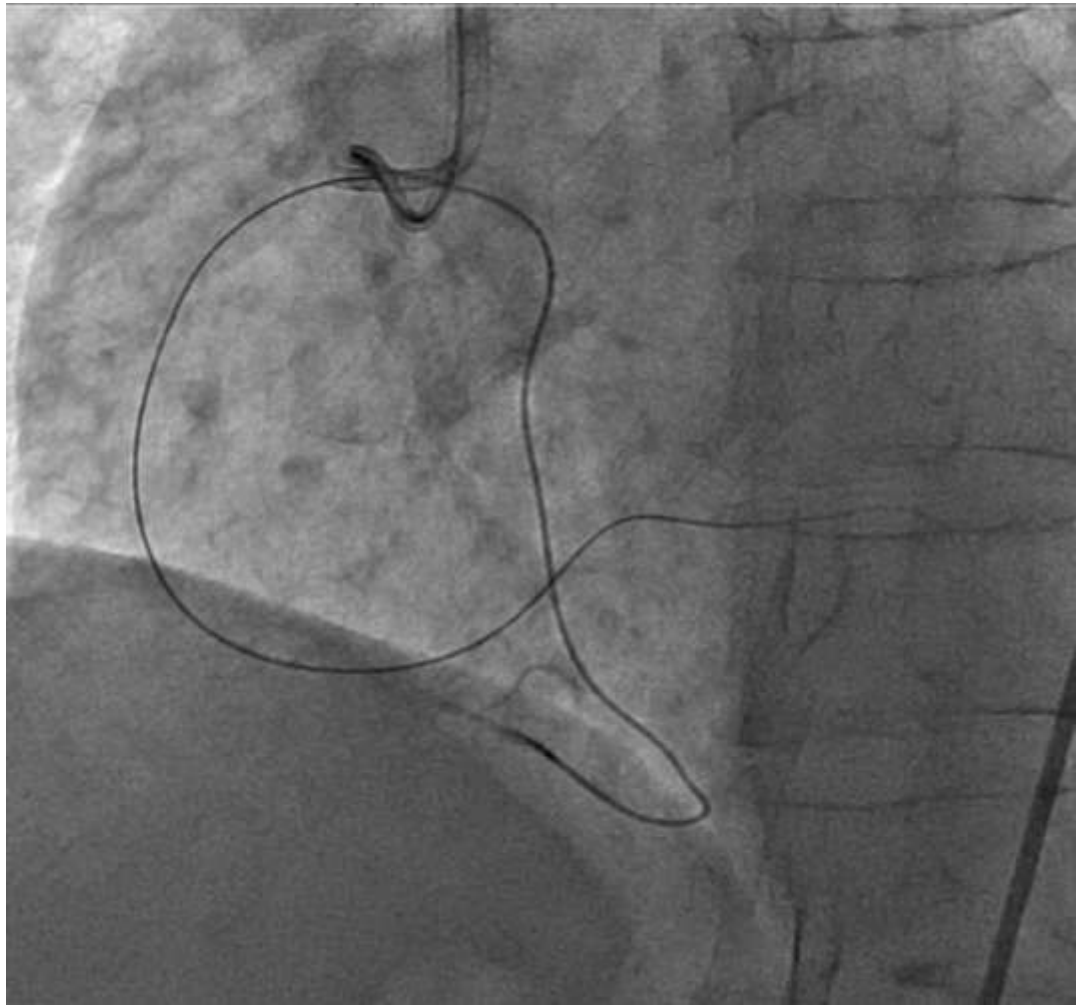


Switch strategy (8)

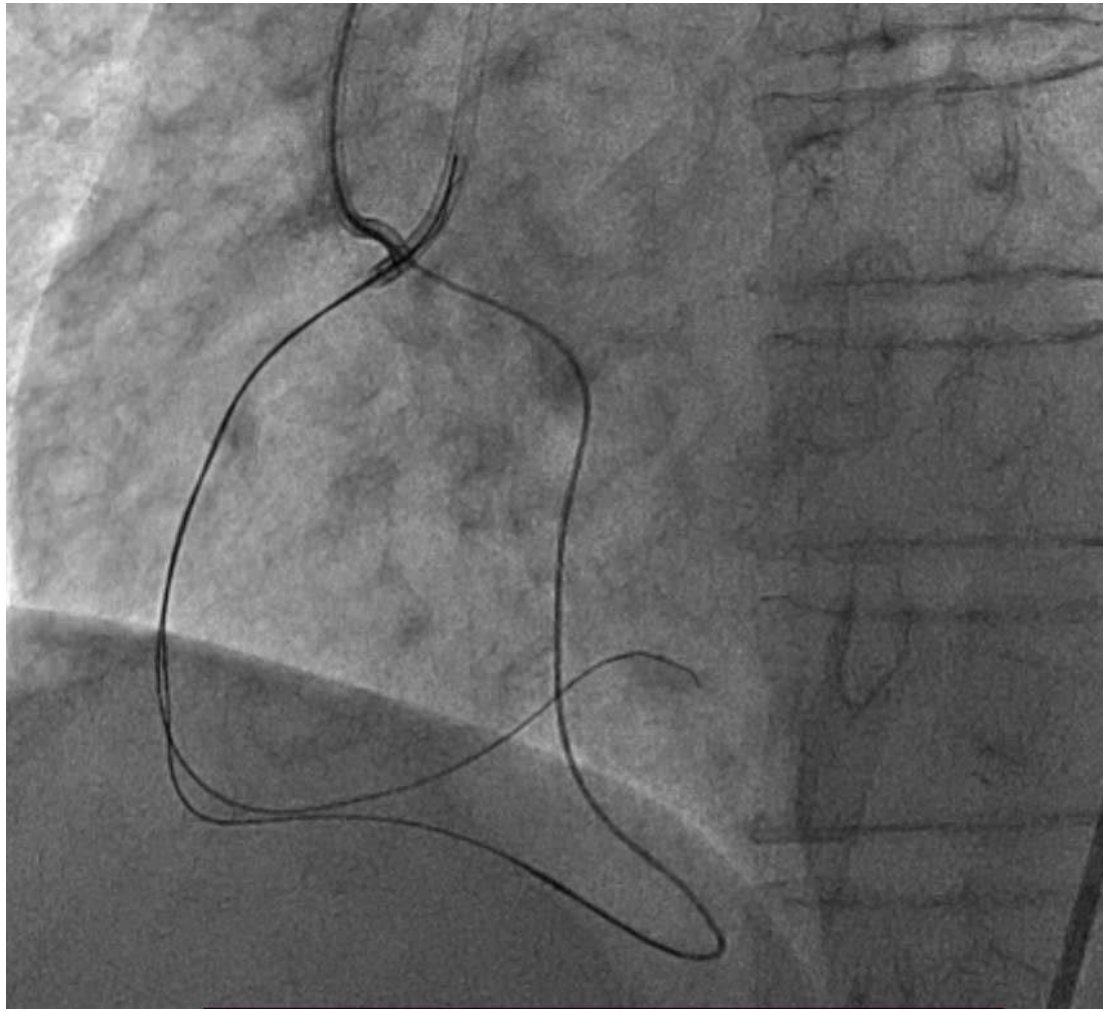




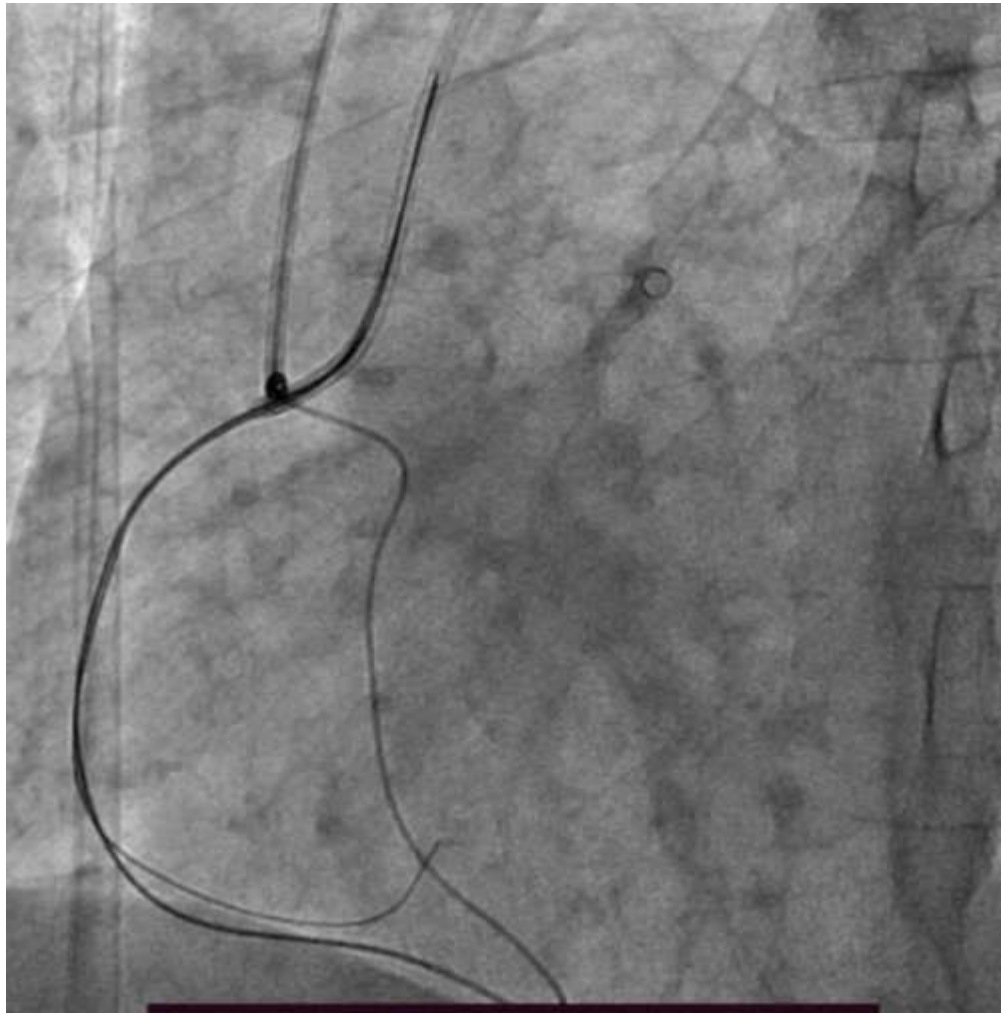
(7) Retrograde access



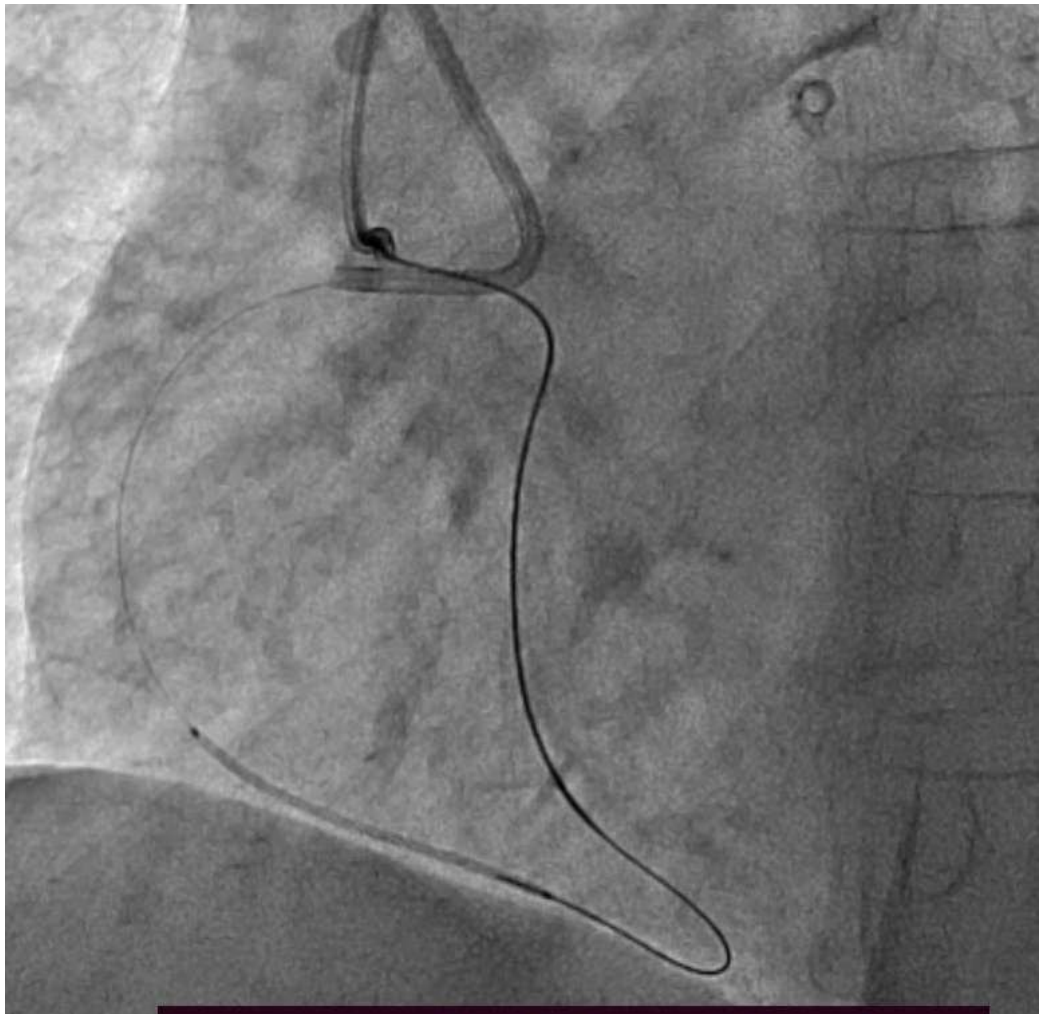
Diastasis of the wires



Tip-In

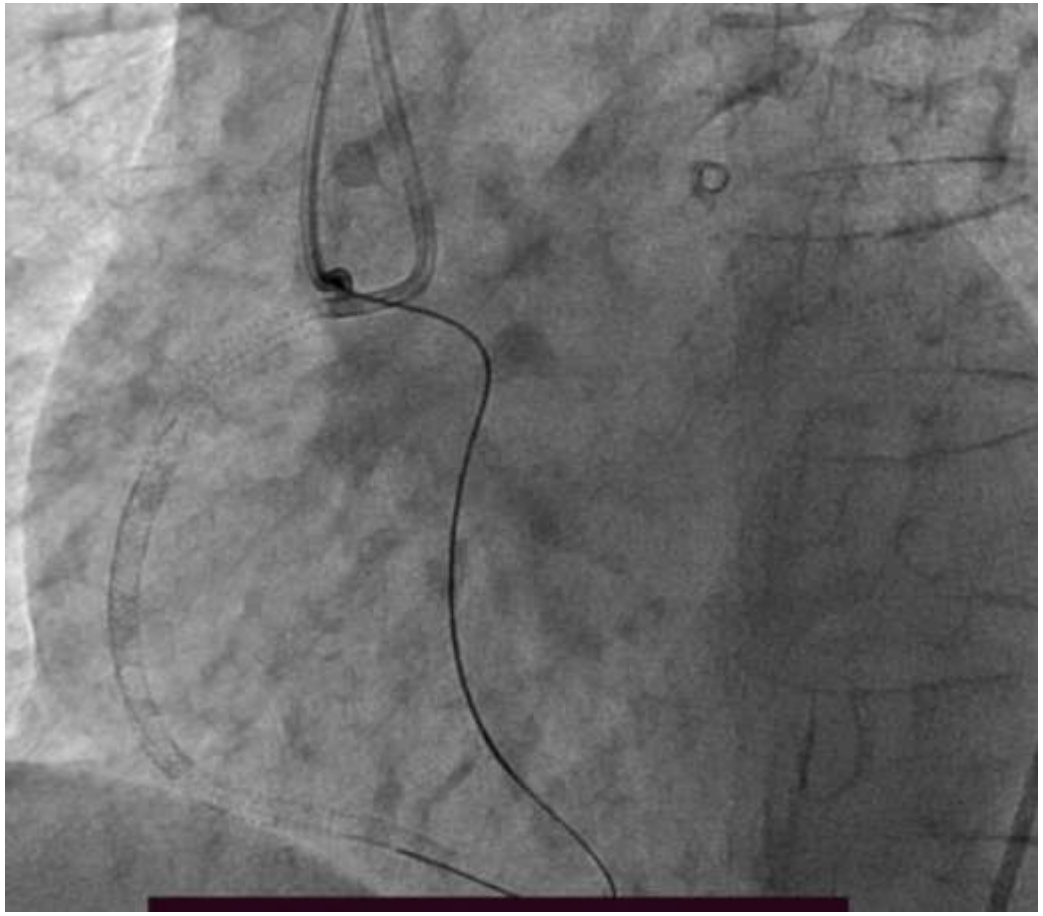


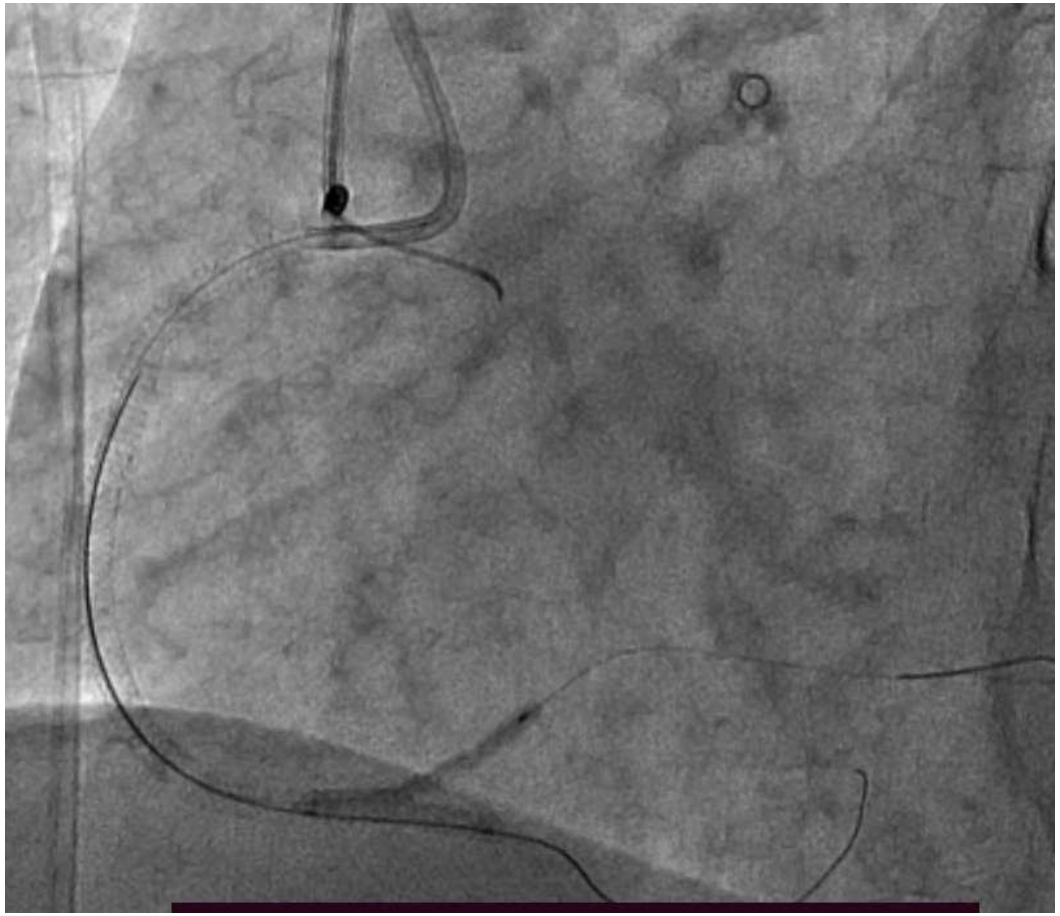
Wide RCA Dissection



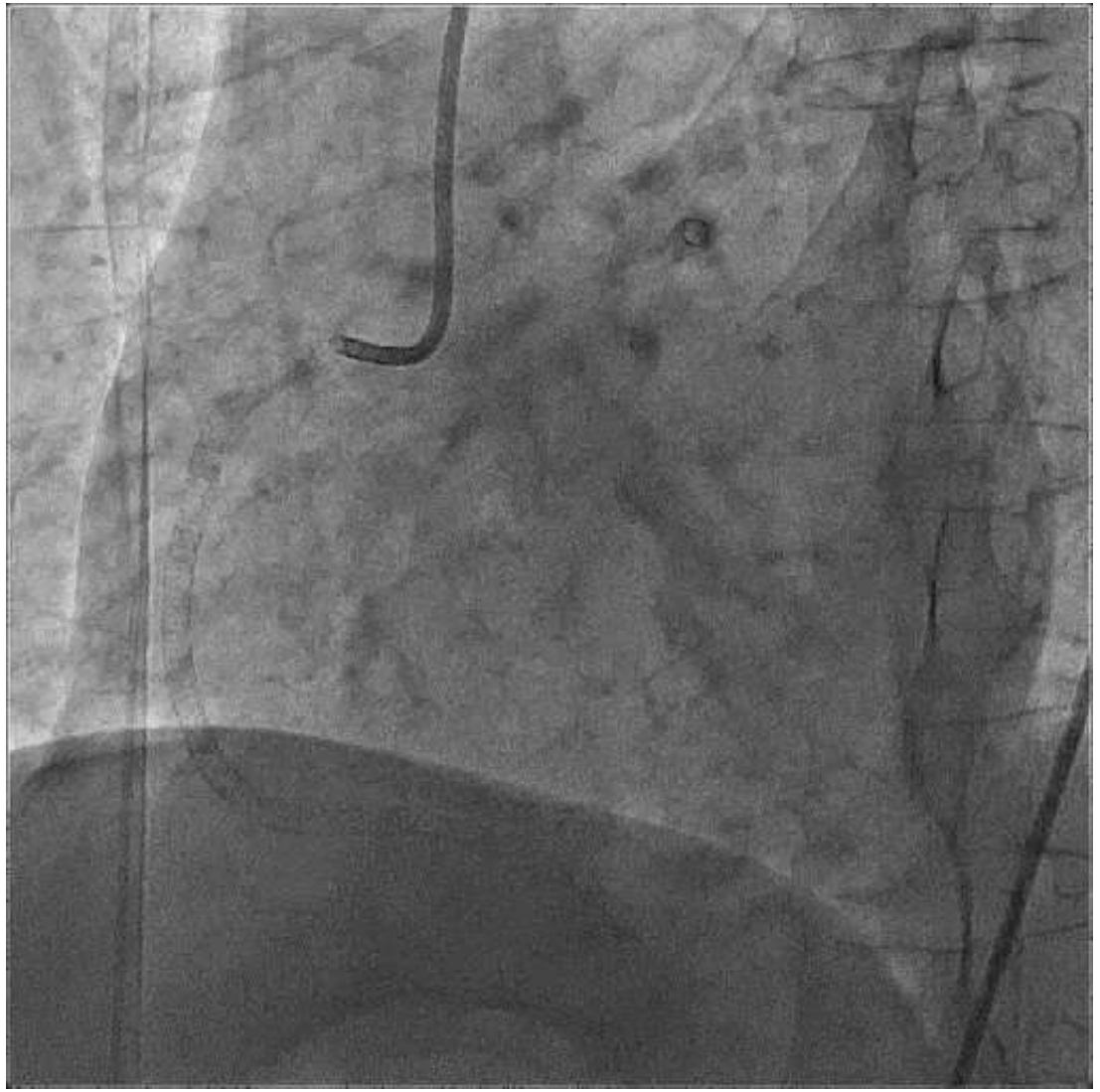
Enough?..

Kiss!



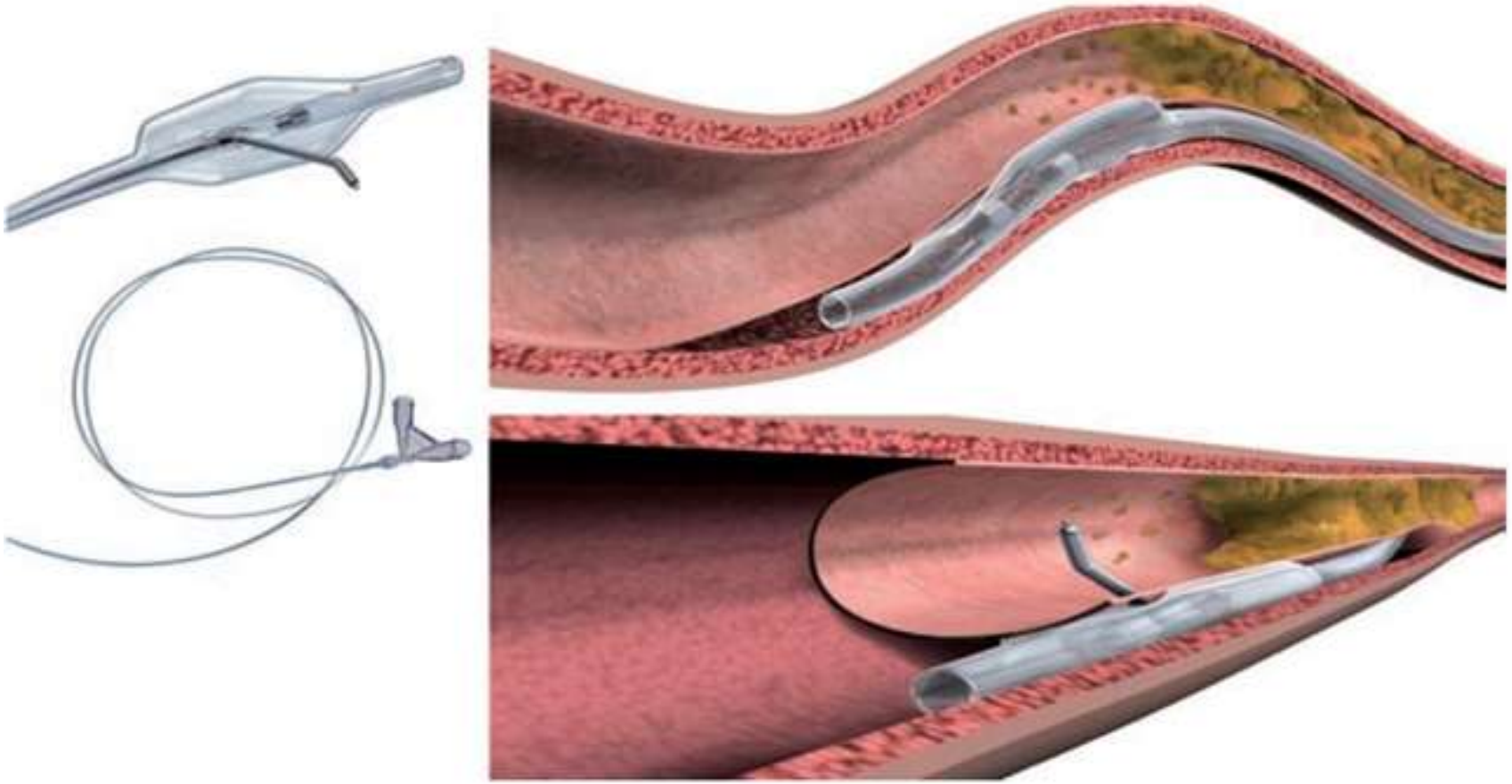


Final Result



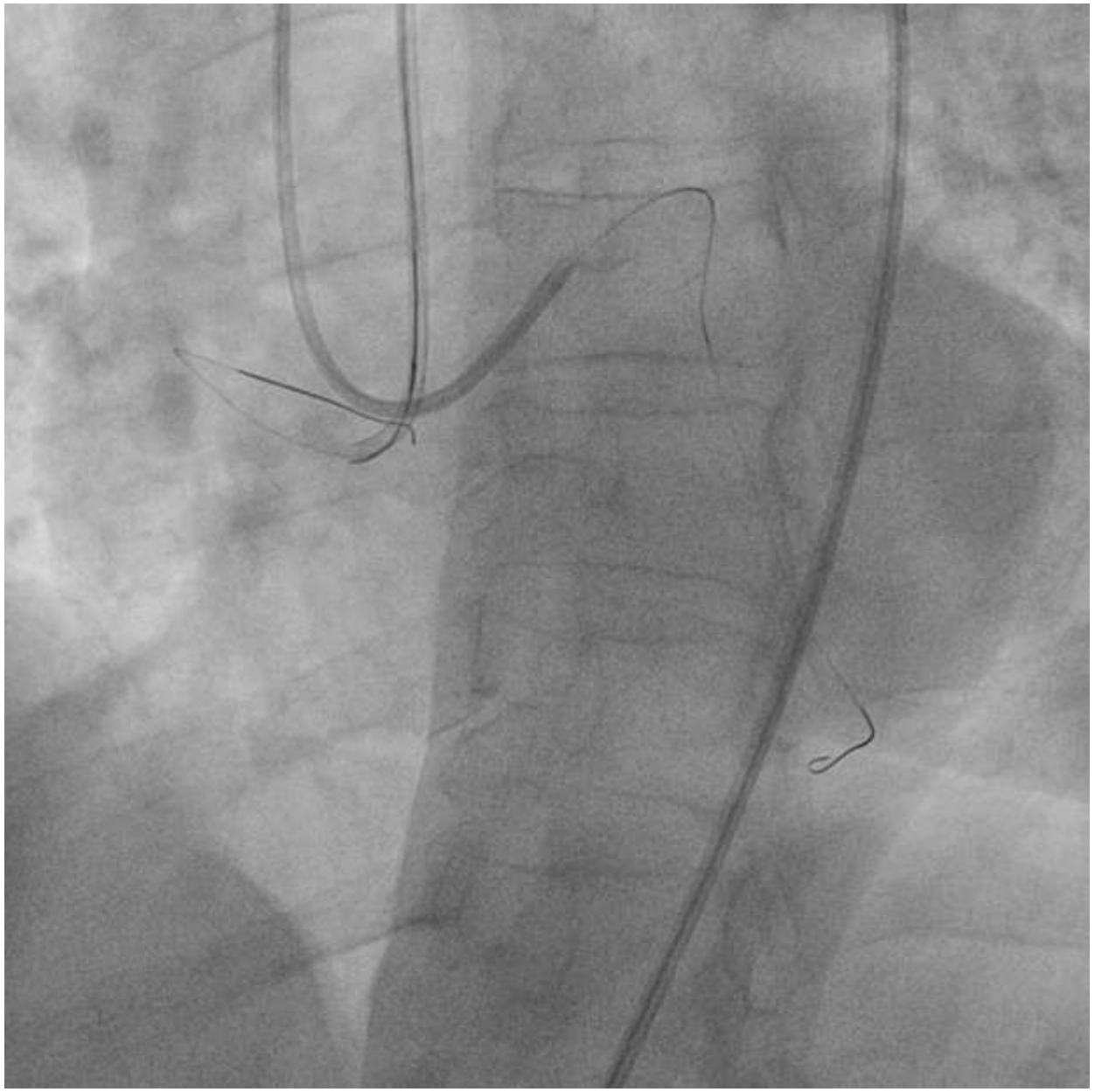
Device-based ADR

- Stingray System

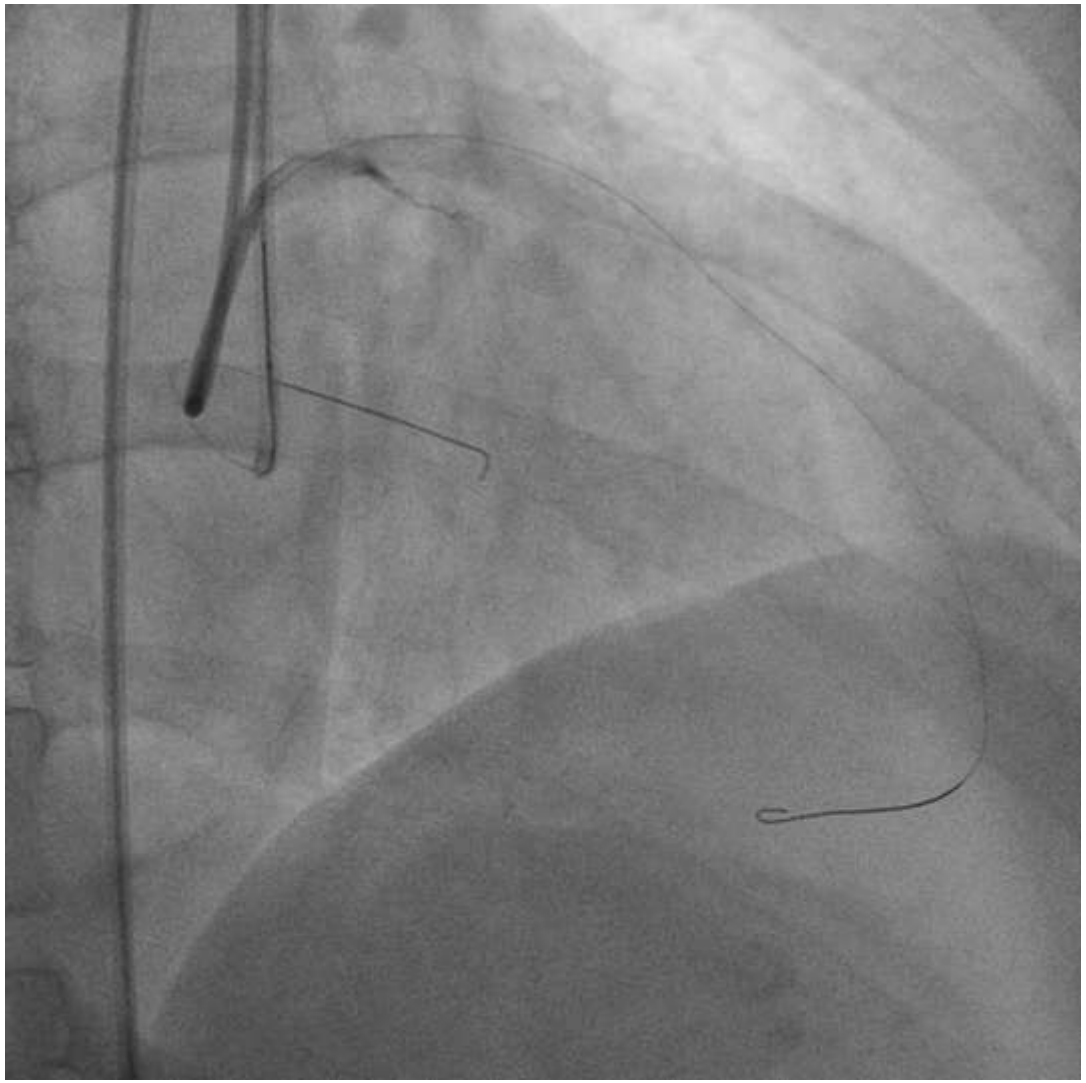


Patient H. 64 yo, f

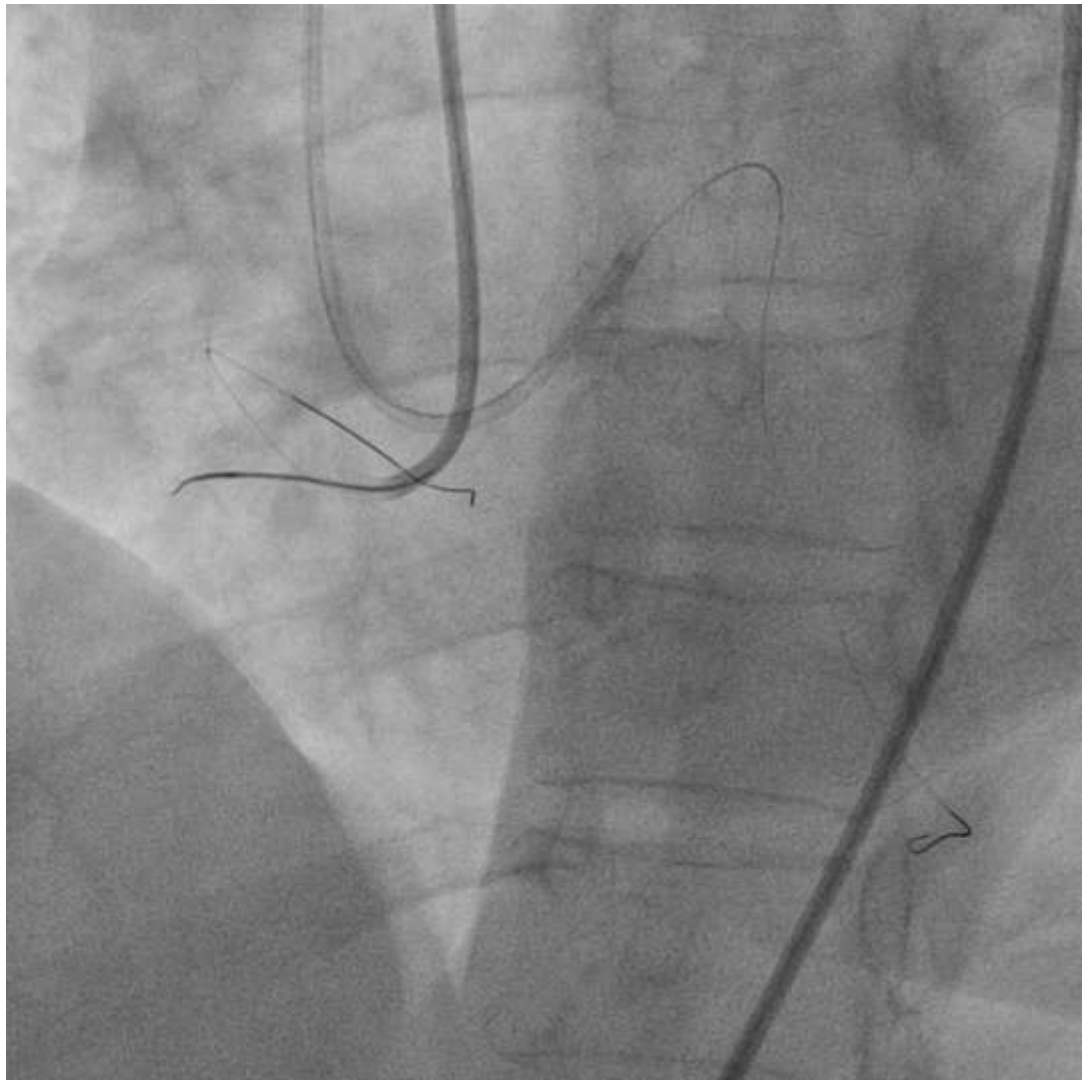
- Mild angina
- Multiple attempts - RCA CTO



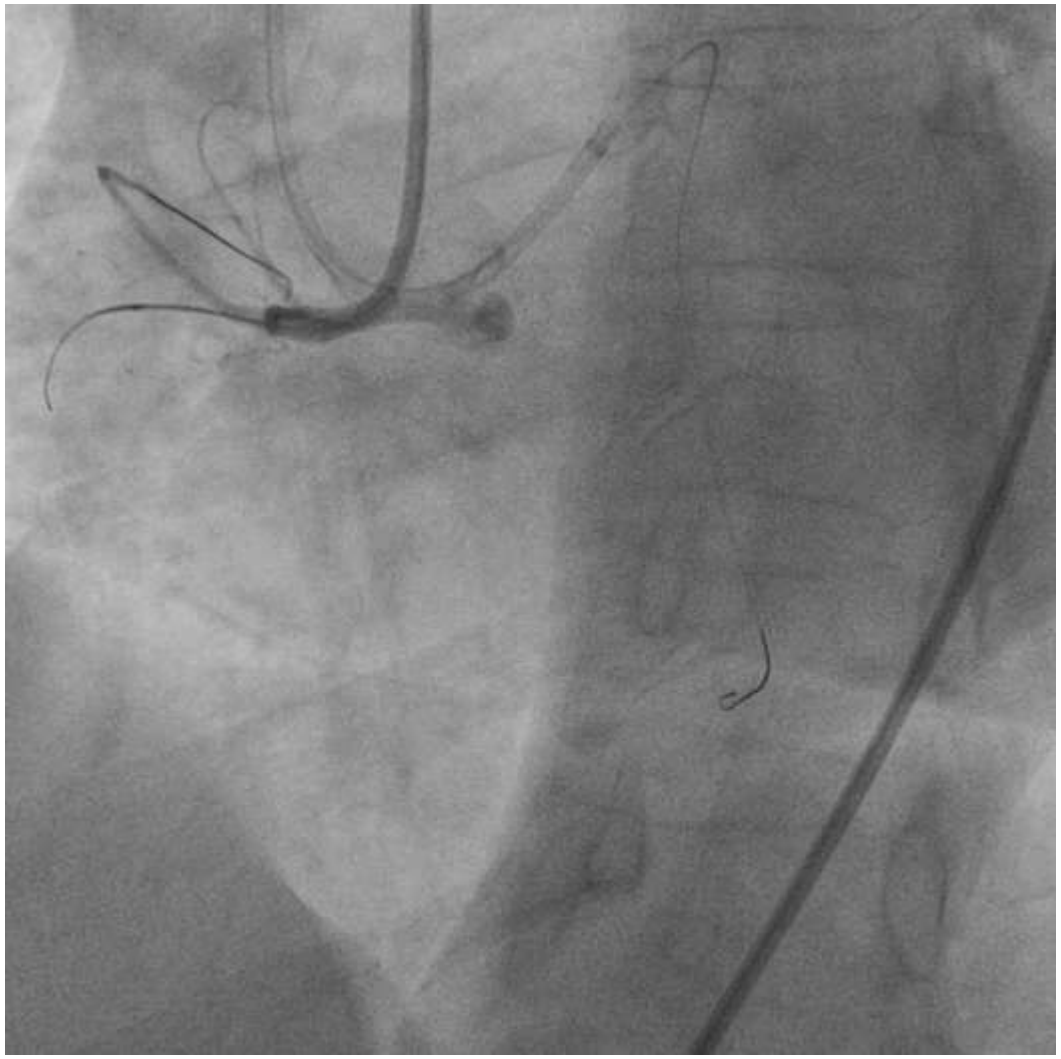
AVG collaterals

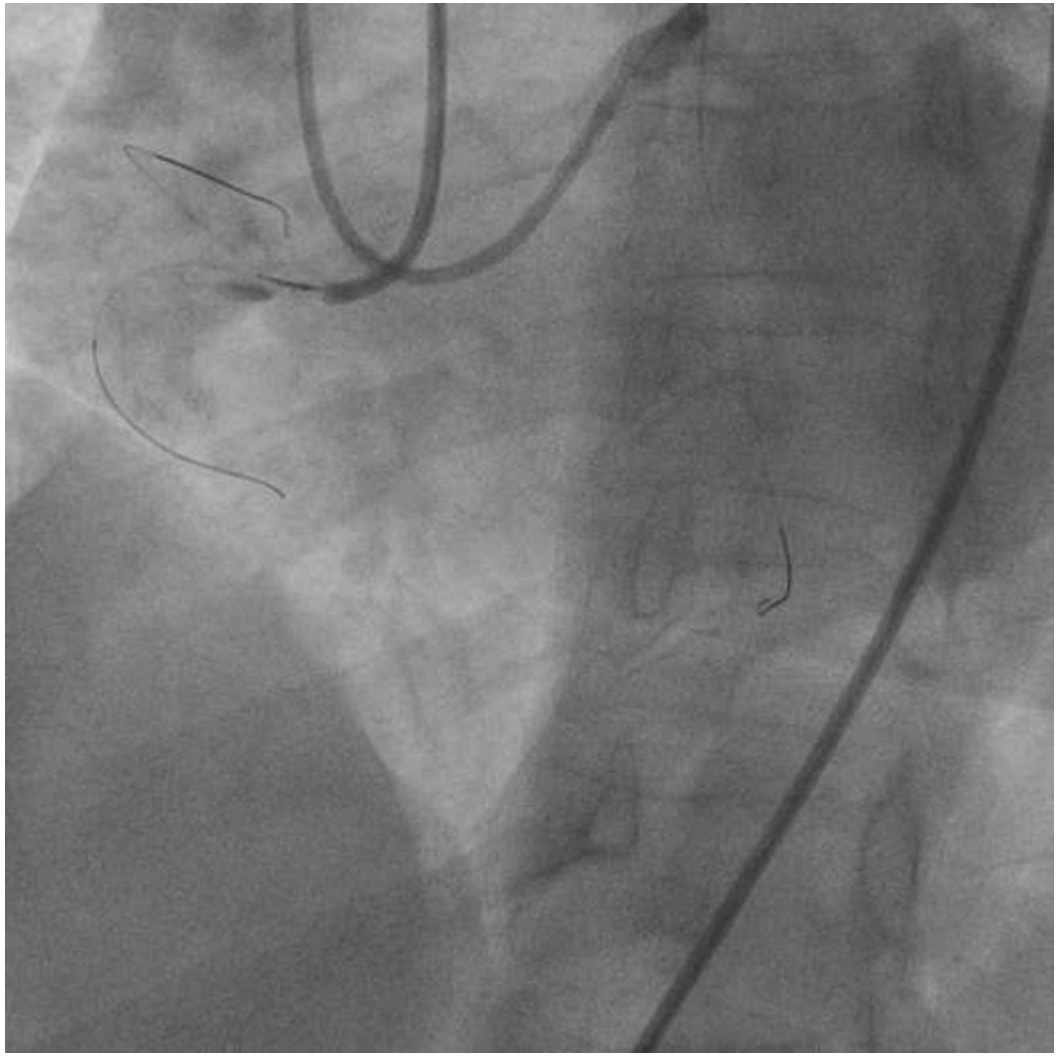


Progress80 + Corsair



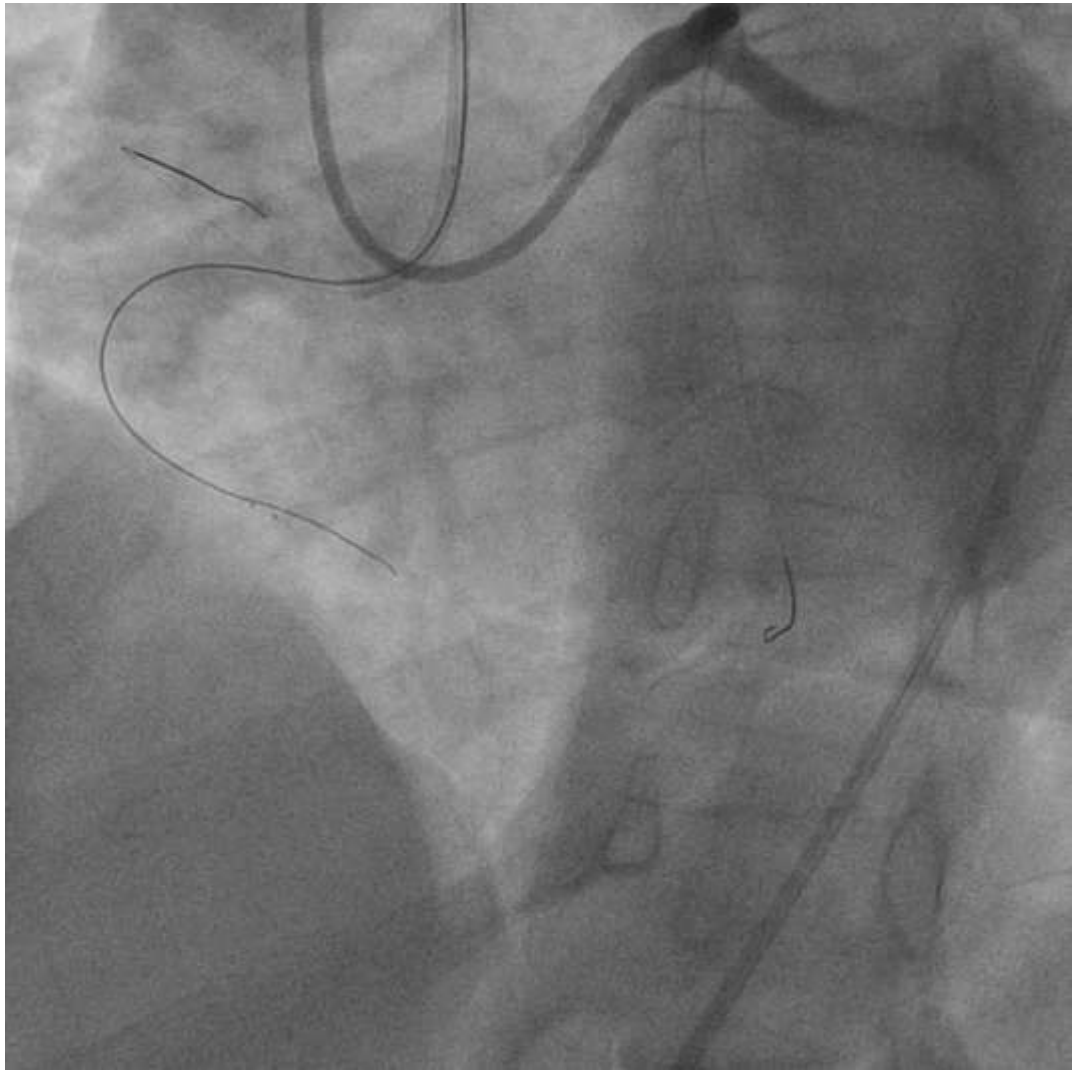
Time to reentry



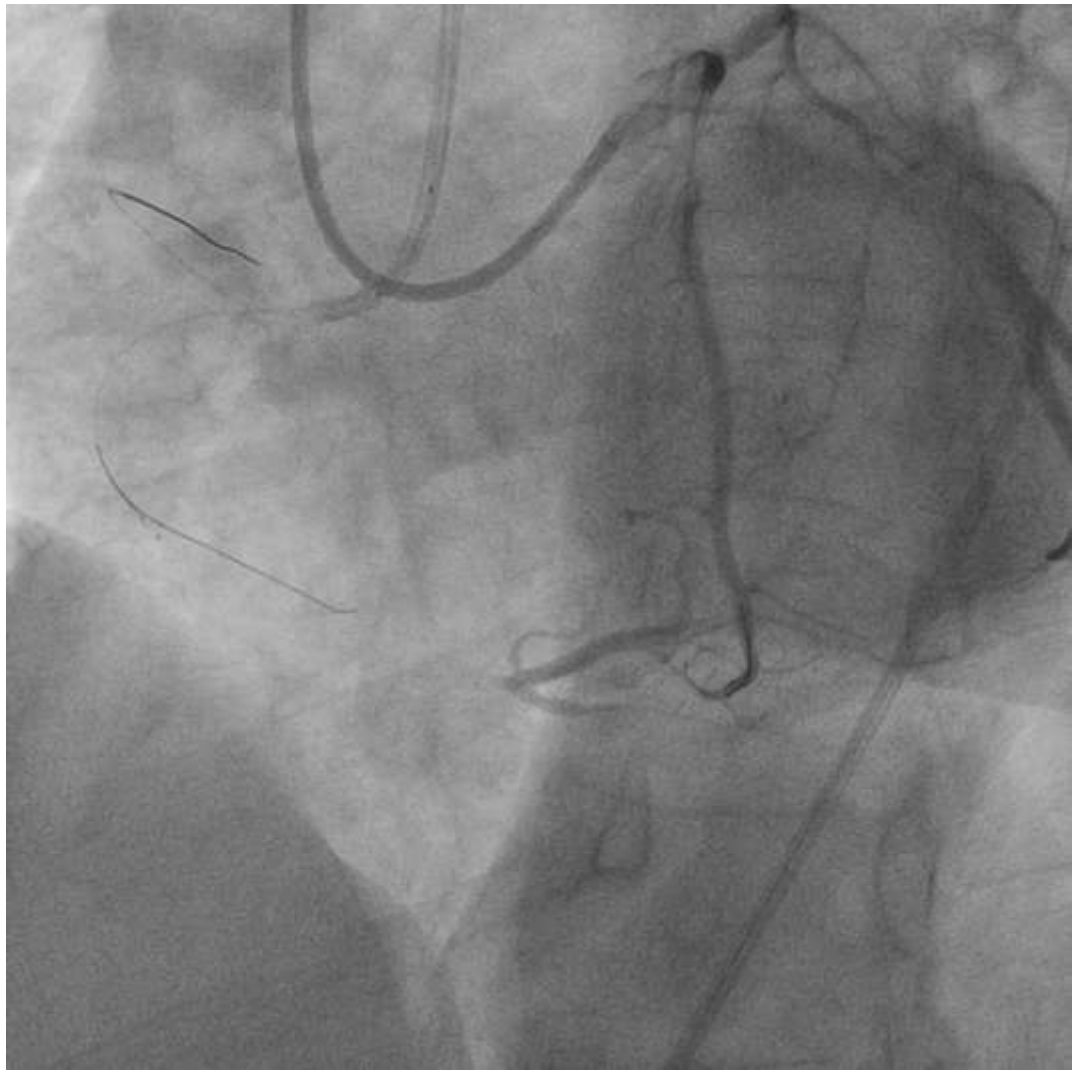


Stingray Reentry

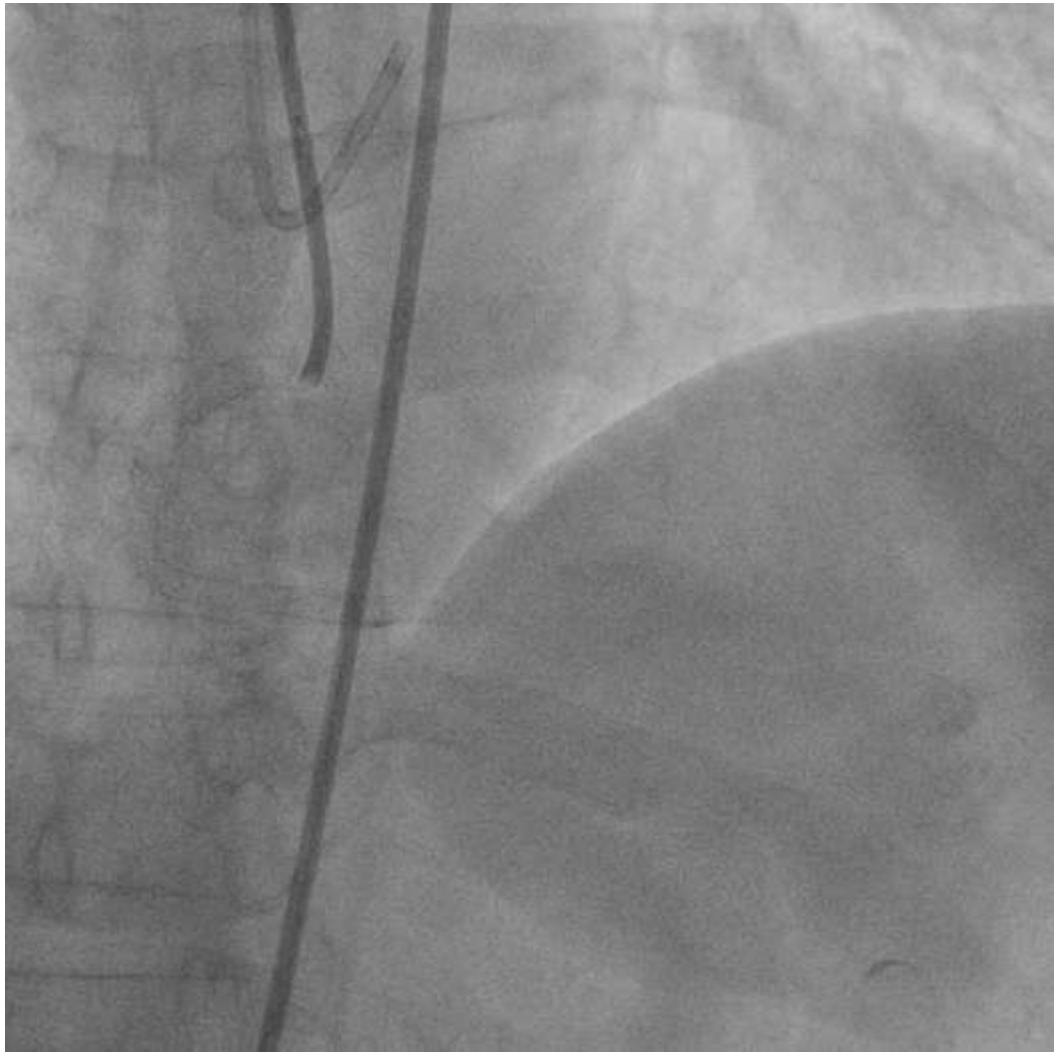
Conquest pro 9

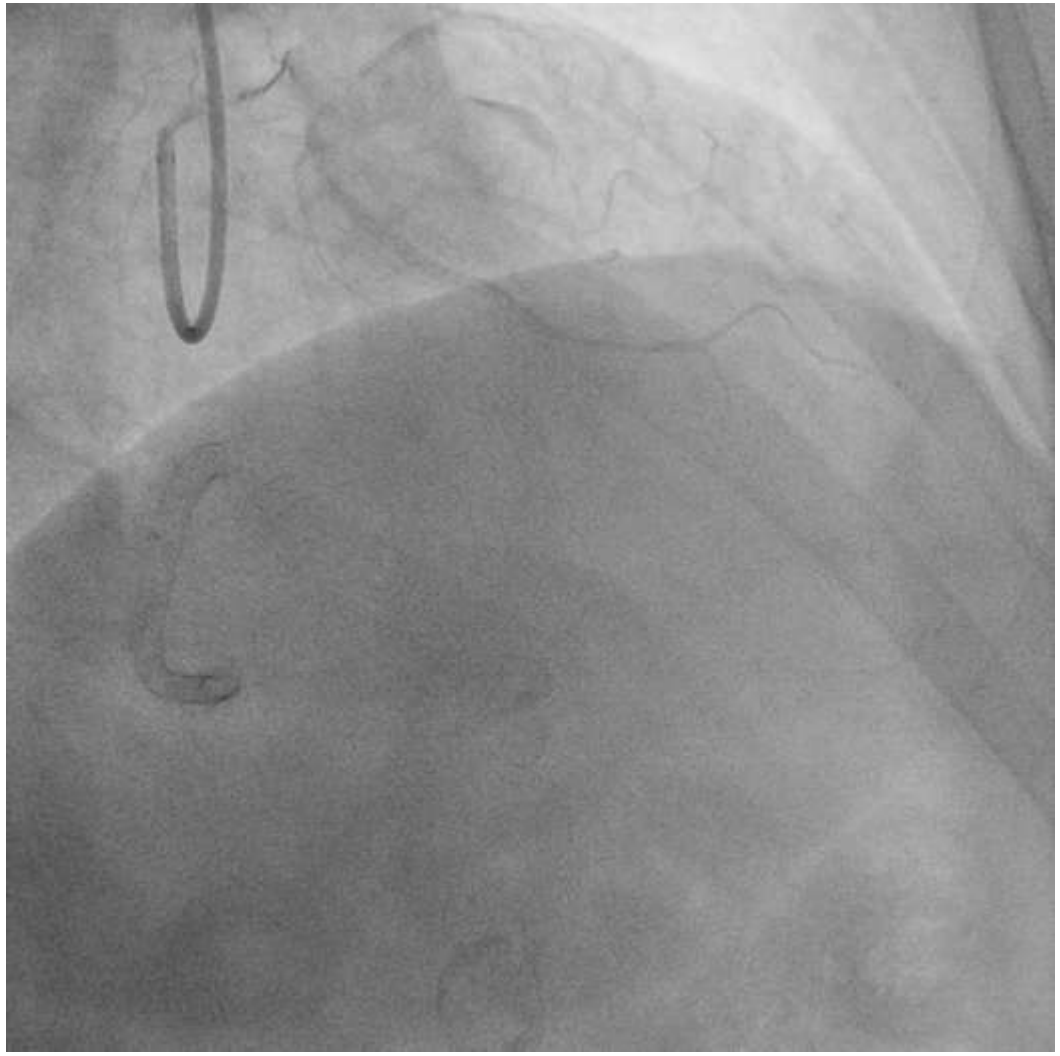


Hornet 10



Финальный результат





Utility of Intravascular Ultrasound in Percutaneous Revascularization of Chronic Total Occlusions

An Overview

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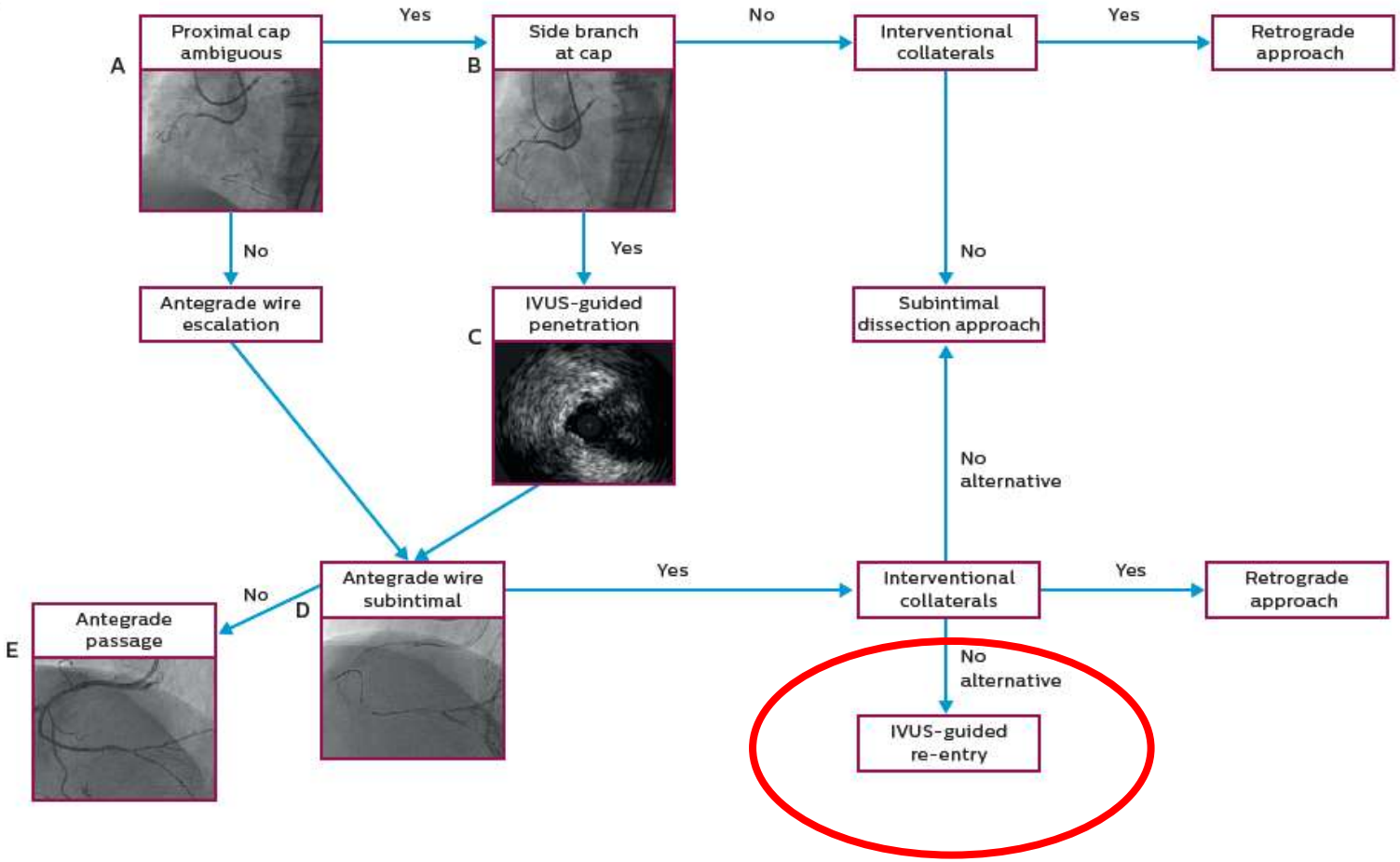
Carlo Di Mario, MD,[f] Roberto Garbo, MD,[g] James C. Spratt, MD,[h] Evald H. Christiansen, MD, PhD,[i]
Andrea Gagnor, MD,[j] Alexandre Avran, MD,[k] Georgios Sianos, MD, PhD,[l] Gerald S. Werner, MD[m]

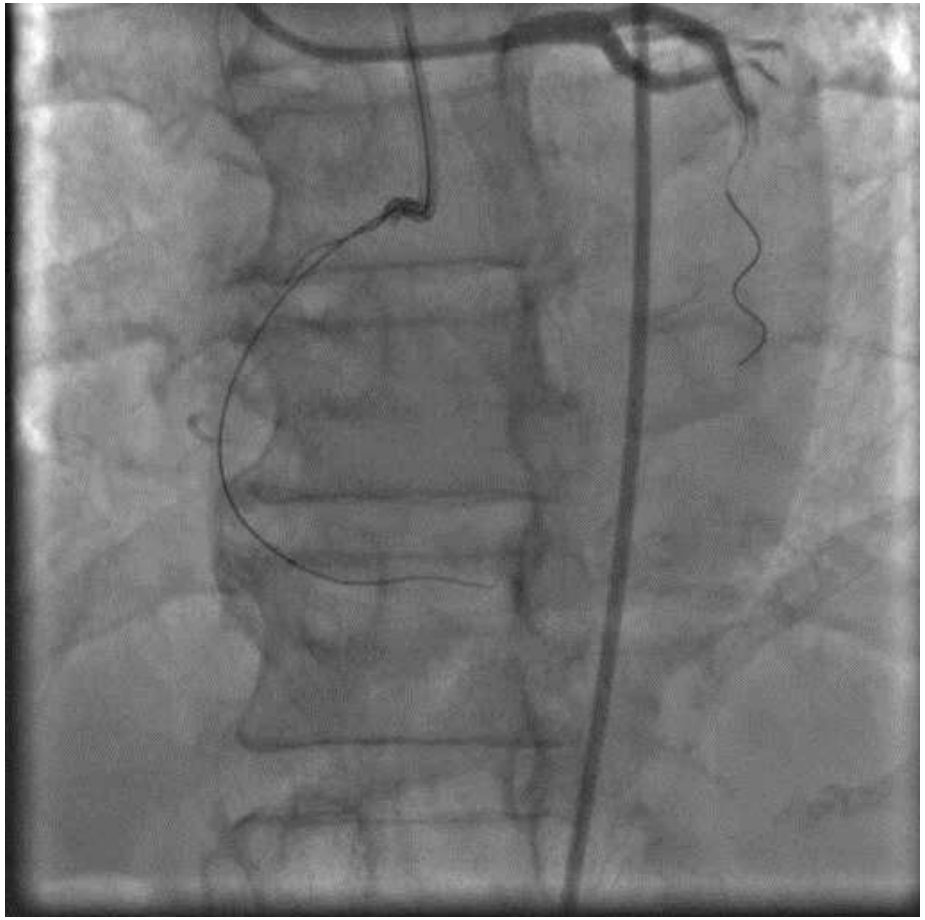
IVUS-guided reentry



Patient Presentation

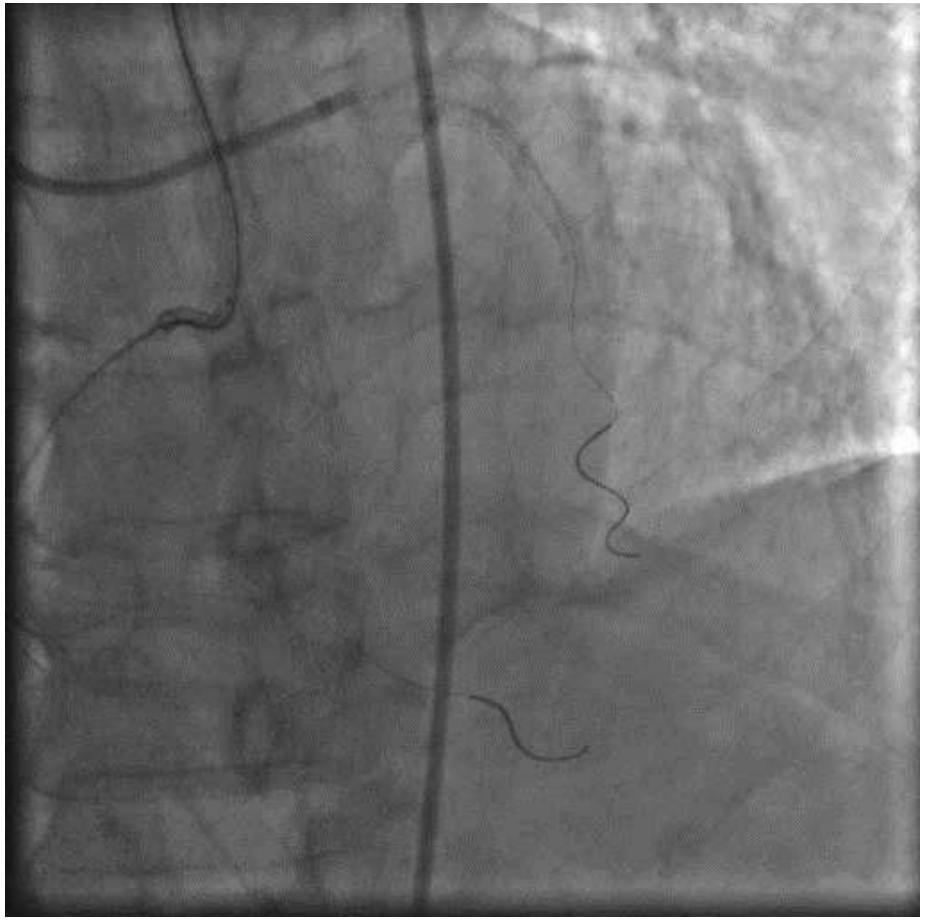
- Patient B., 70 yo, male
- Class 2 effort angina
- Previous attempts
- Preserved EF - 48%, w/o akinesis
- Ischemia and viability - veryfied

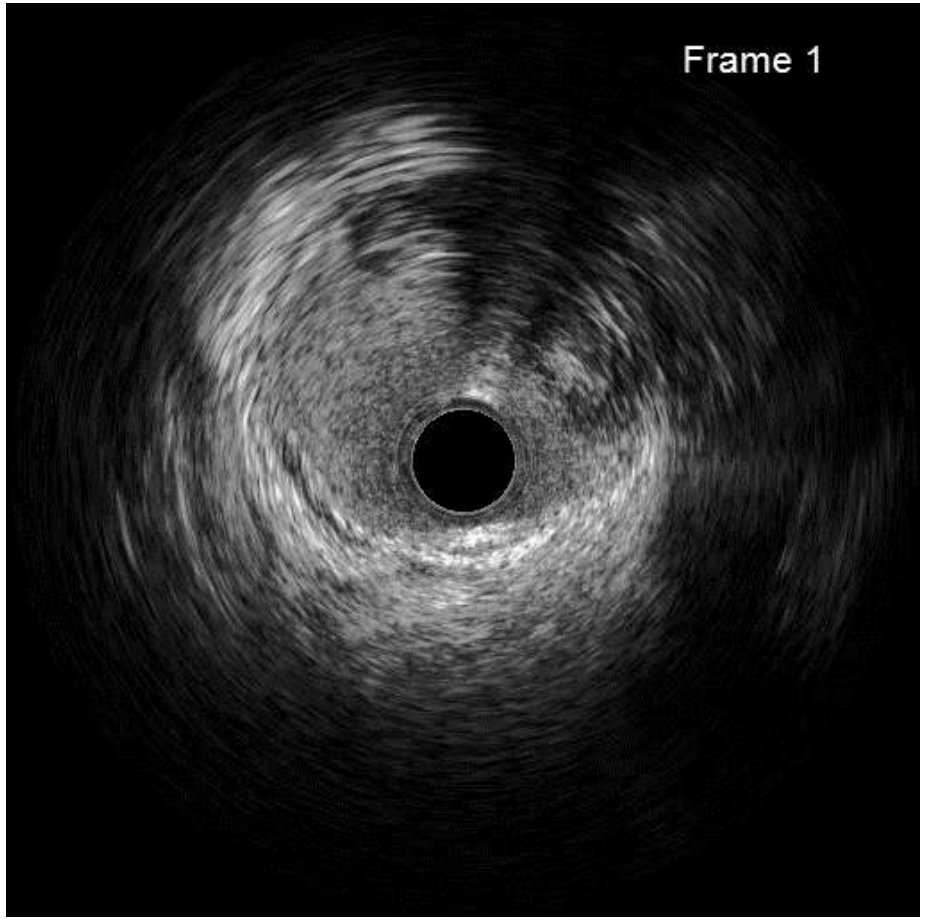
Finecross + Gaia sec



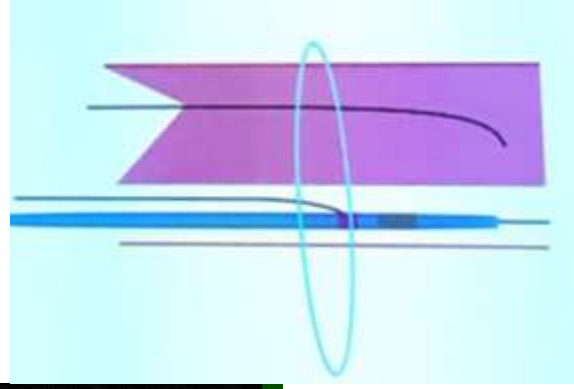
Parallel wiring

IVUS after knuckle

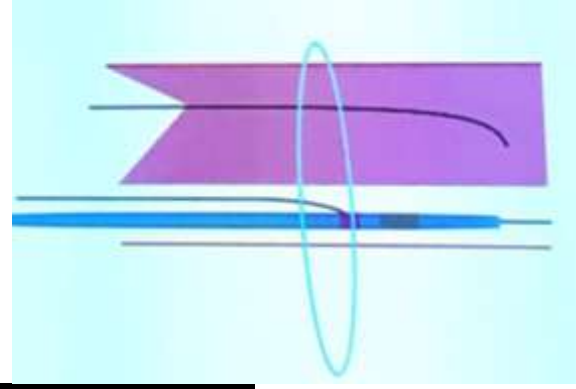


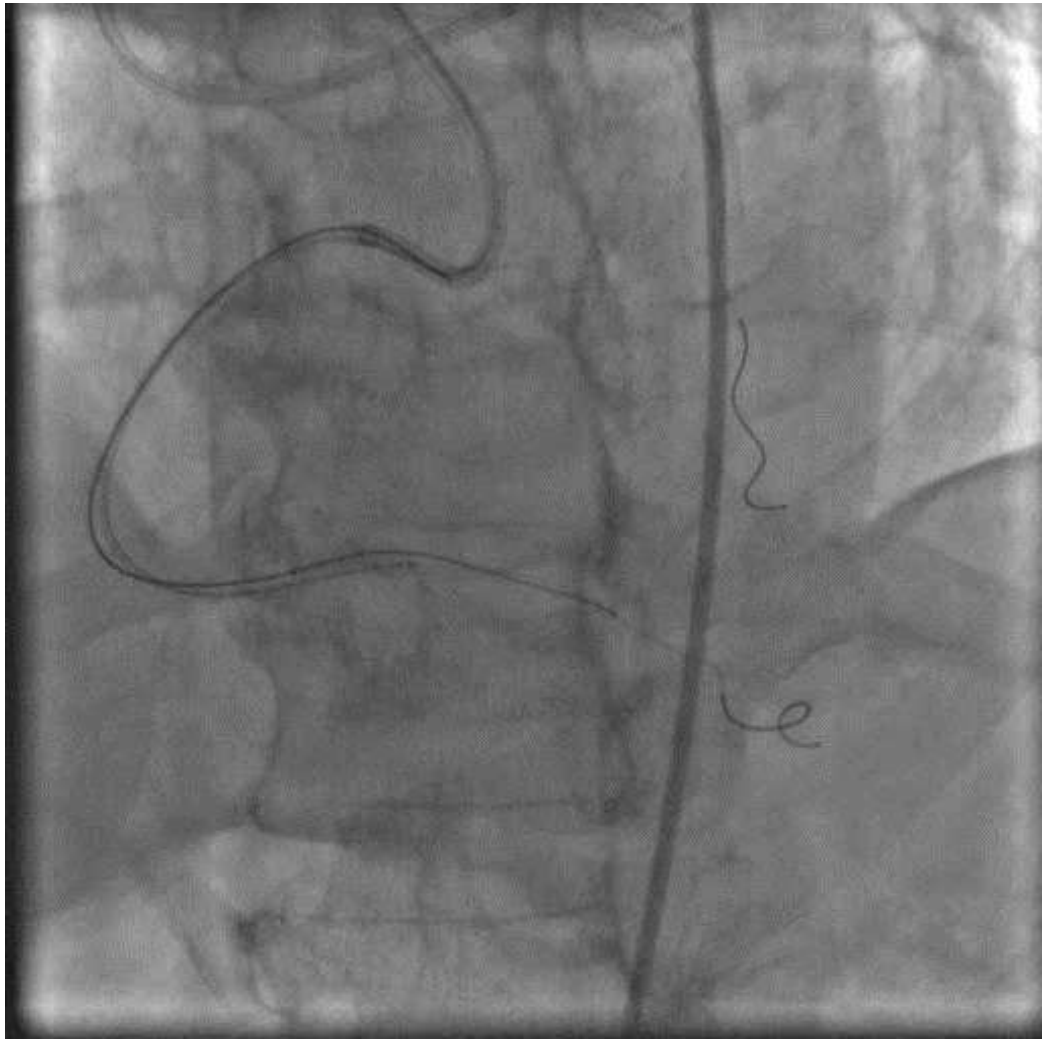


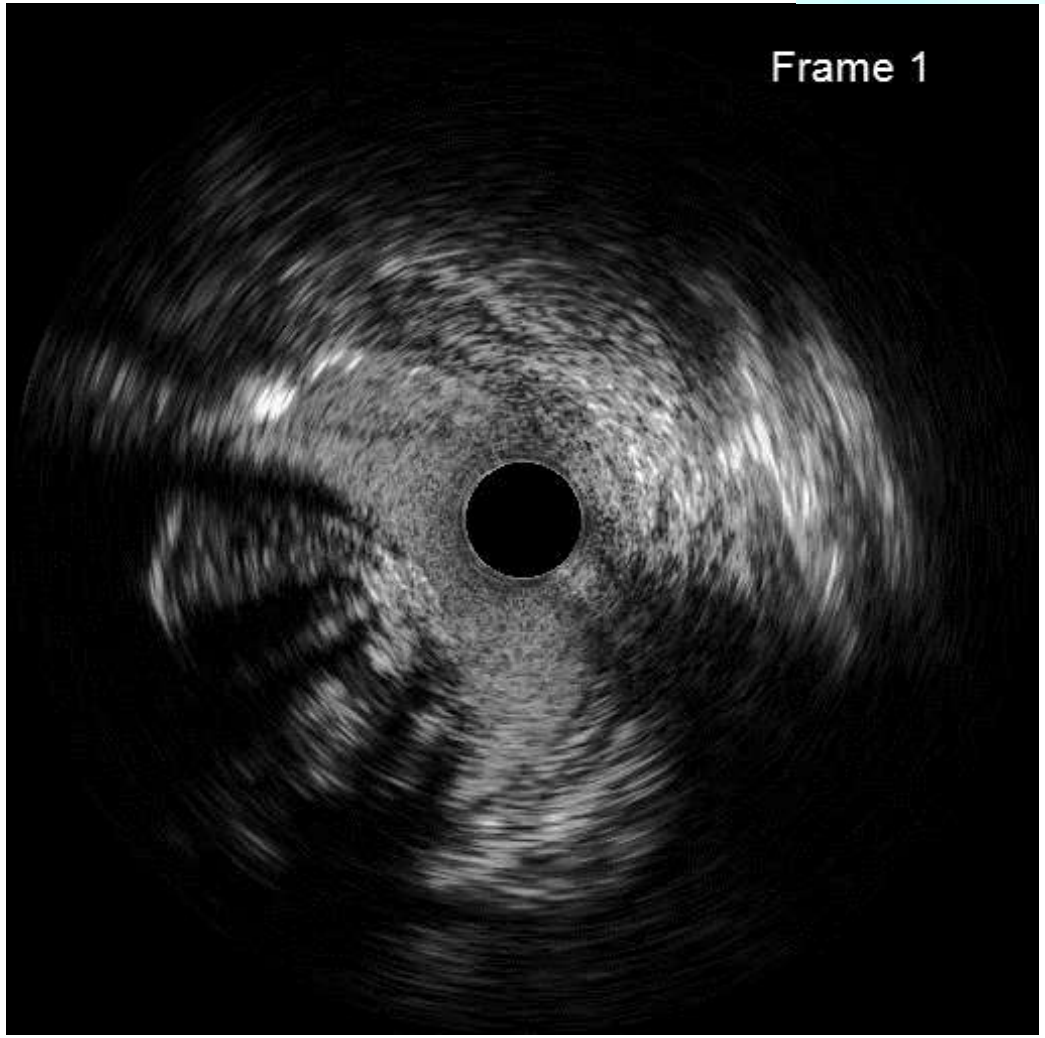
IVUS-assisted re-entry to the true lumen



Wire position in the true lumen

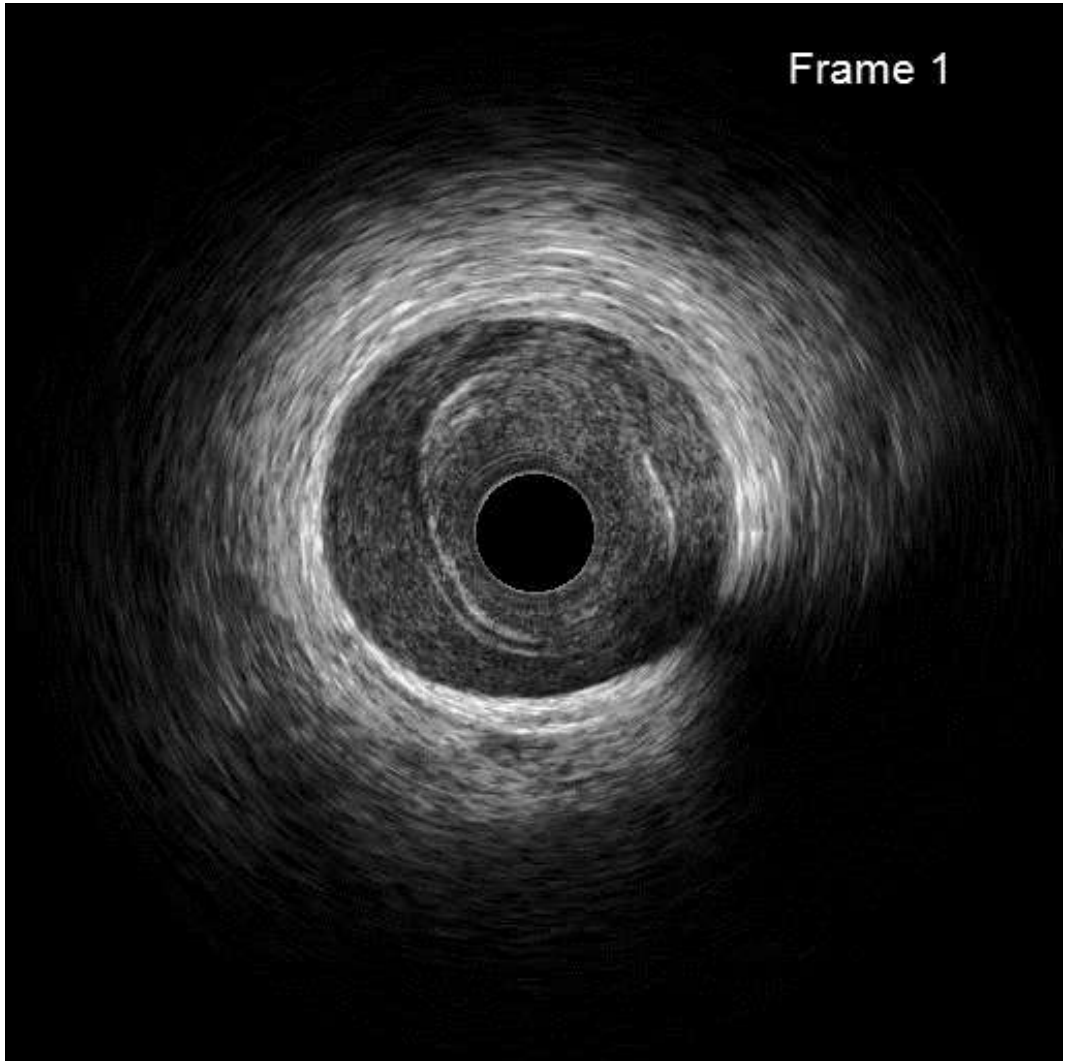




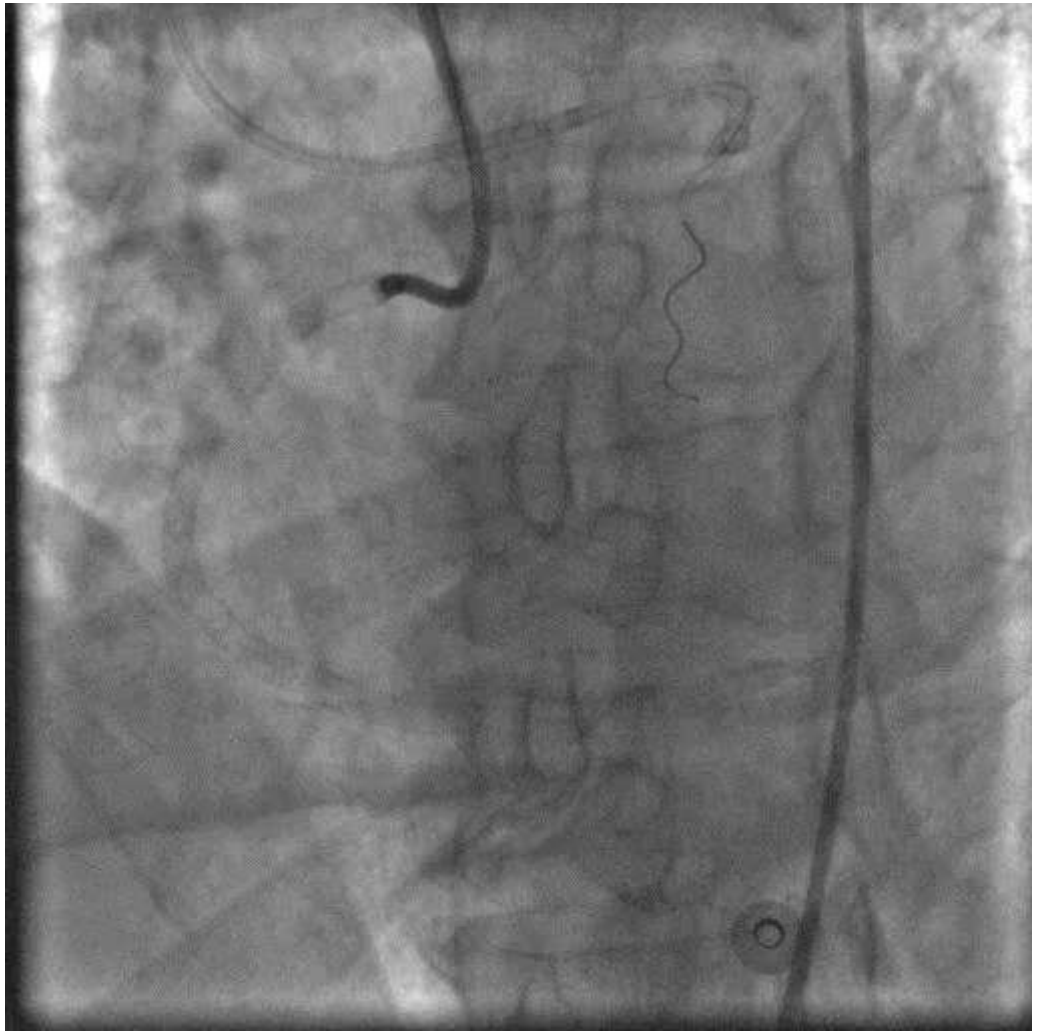


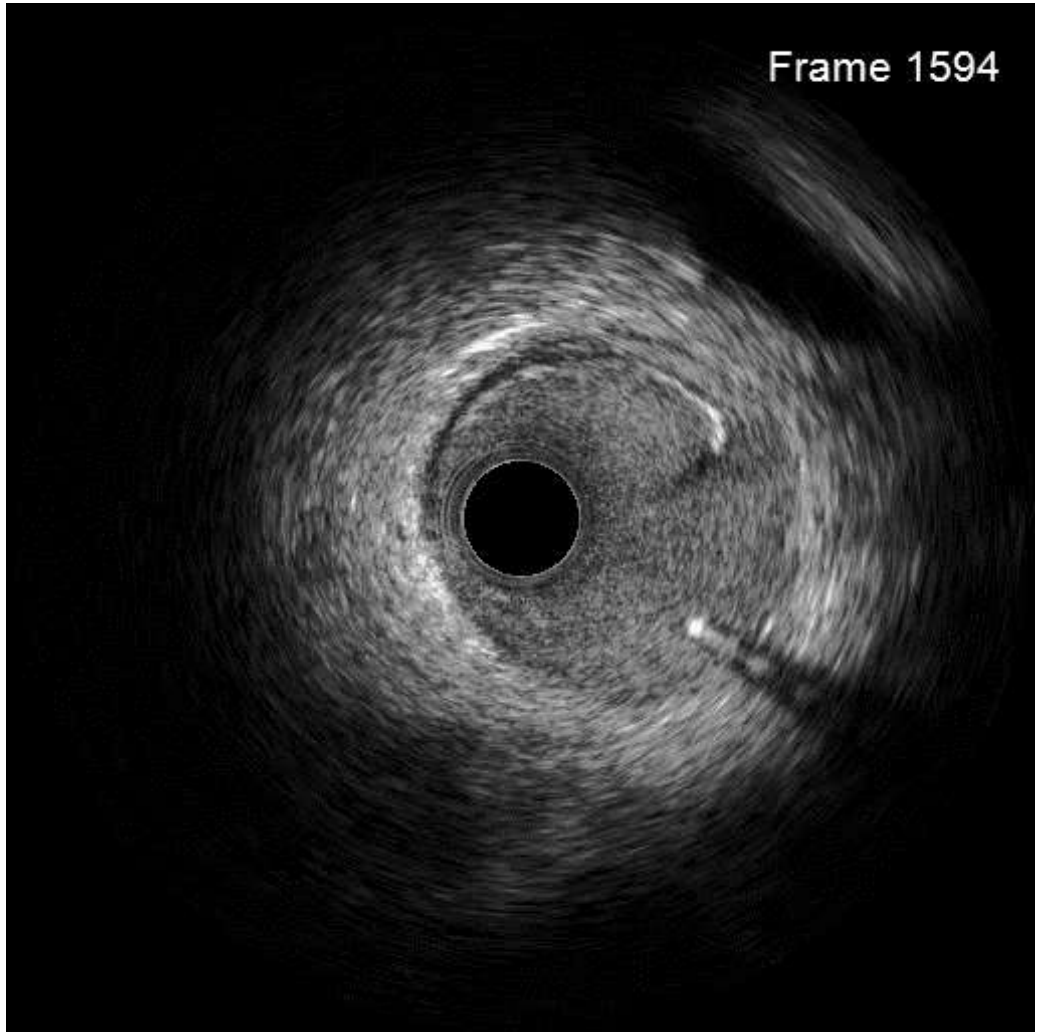
IVUS from PDA

- Subintimal hematoma in PDA
- Patent bifurcation of RCA
- Calcified lesion in crux



Final Result





Professor Yamane
When and how to finish (9,10)?

- Procedure lasts more than 3 hours without significant progress
- Contrast medium - 3 x eGFR, ml
- Air Kerma > 5 Gy without progress
- Fatigue of the patient and/or operator
- Investment procedure

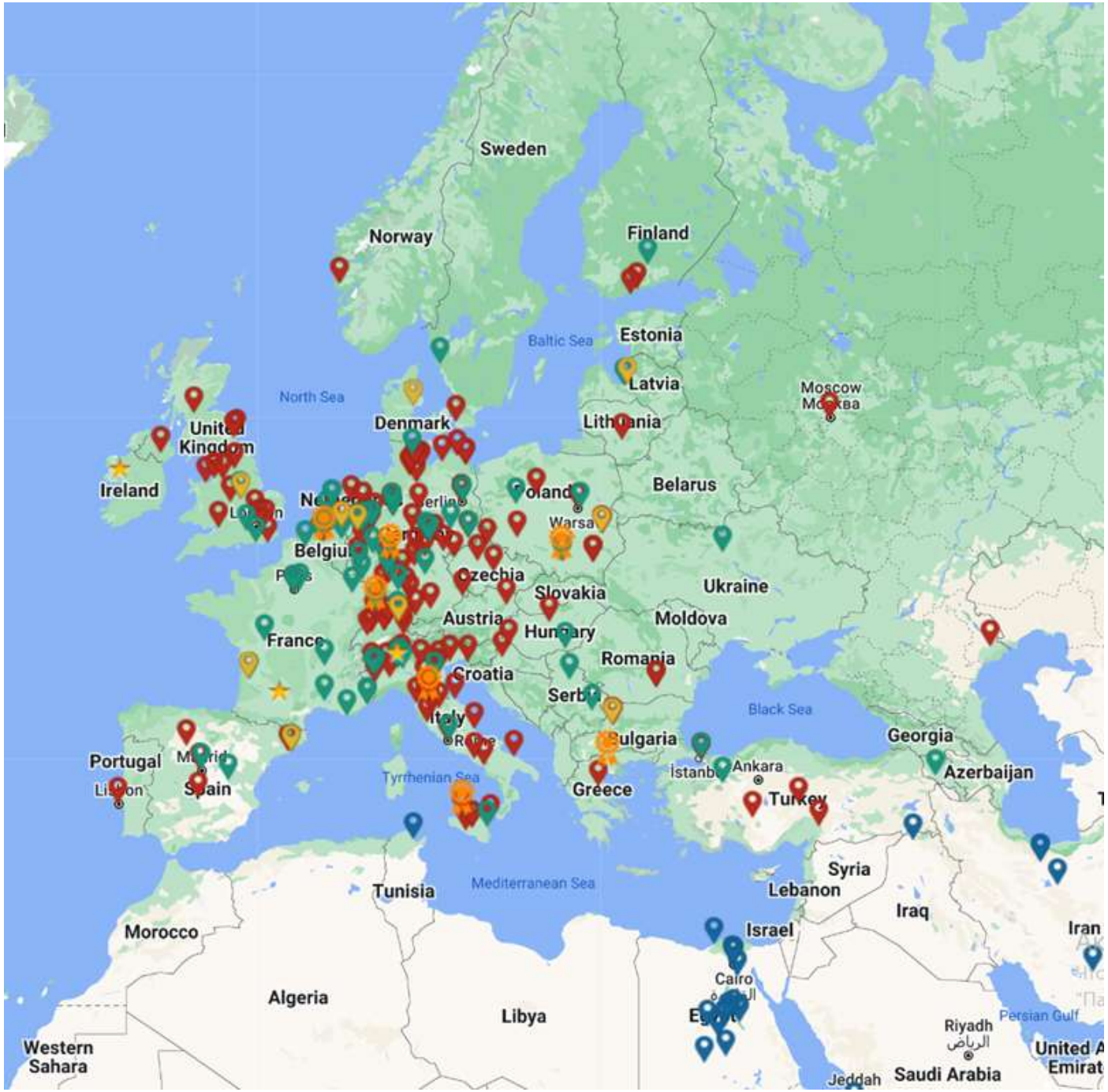
Professor Semitko
Ad-hoc CTO, OTW balloons, Single wire are the Past!

- Elective recanalization
- Dual injection
- Use microcatheter
- Guiding catheters with increased support 7Fr, 8Fr and guide-extensions
- Start antegrade – success rate up to 70%
- Don’t forget to switch retro – and return ante- if necessary
- IVUS - guidance

Learn and travel!!!

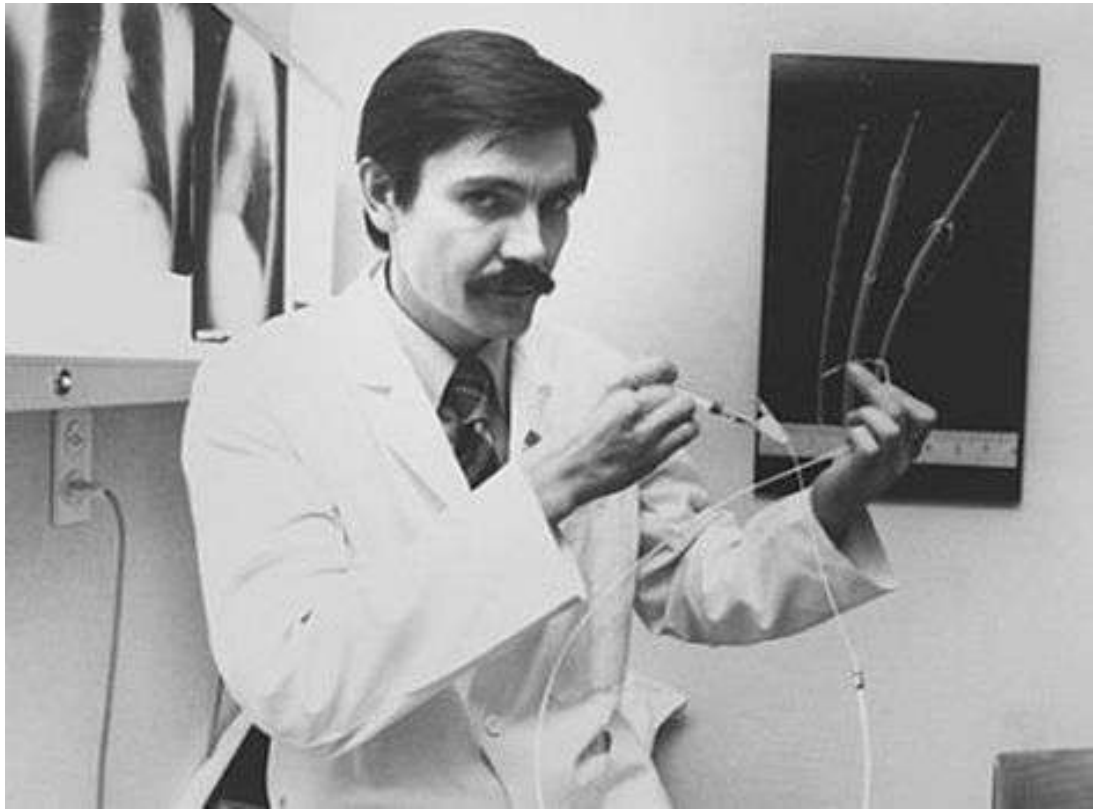
Join Us!!!


EURO CTO CLUB


Sweden
Norway
Finland
Baltic Sea
Estonia
Latvia
North Sea
Denmark
Lithuania
Moscow
Belarus
Ireland
Poland
Warsaw
Czechia
Slovakia
Ukraine
Austria
Moldova
France
Romania
Croatia
Black Sea
Georgia
Portugal
Spain
Tyrrhenian Sea
Greece
Azerbaijan
Turkey
Ankara
Syria
Tunisia
Mediterranean Sea
Lebanon
Iraq
Morocco
Israel
Iran
Algeria
Libya
Cairo
Persian Gulf
Riyadh
Western Sahara
Jeddah
Saudi Arabia

Professor Ochiai – learning in CTO‘s consists of the student standing next to me and watching me struggle

Professor Gruentzig



"… the total closure is a real problem, if we cannot solve the total closure problem we probably will never really address the question of multivessel dilatation."

Andreas Gruentzig