

Invest to treat DCB for Complex CTO PCI at High Risk of Stent Failure

Dr. Nino Cocco

Campus Bio-Medico University Hospital Rome



16.00 - 16.10

CTO & DCB

N. Cocco, Roma





Stop!

We need to work together!

Coronary Drug-Coated Stent

Coronary Drug-Coated Balloon

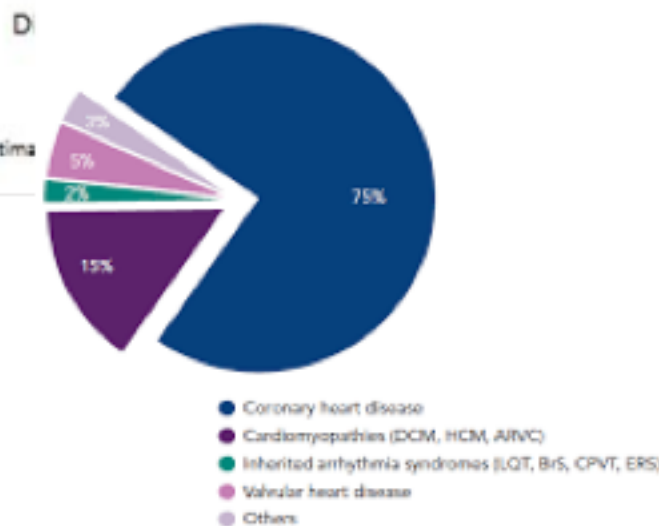
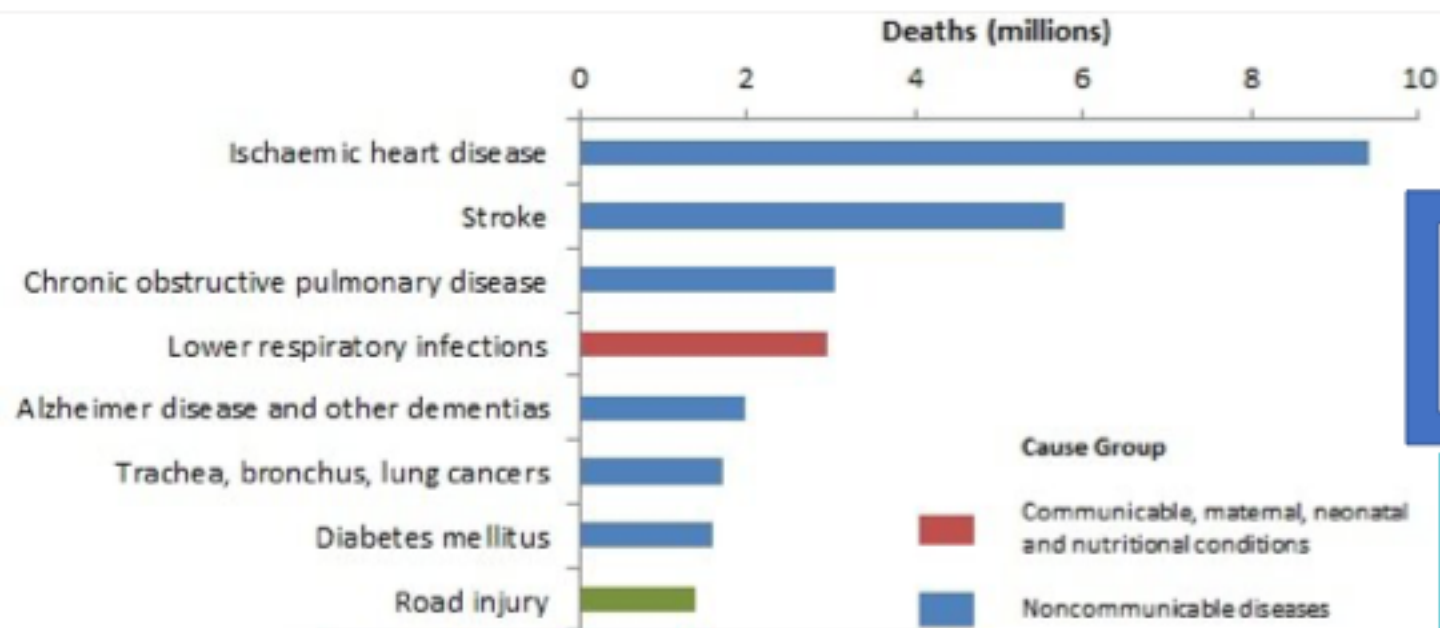
COURAGE
ISCHEMIA

ORBITA
FAME 2
BARI 2

Author (Year)	Key Finding
Weintraub et al. (2007)	<u>No mortality or MI difference</u> ; PCI improved angina/QoL short-term
Sedlis et al. (2020)	<u>No mortality/MI benefit</u> ; more rapid QoL improvement with PCI in symptomatic patients
Bangalore et al. (2013)	PCI reduced spontaneous MI, but increased procedural MI; no net MI difference
Al-Lamee et al. (2017); Rajkumar et al. (2023)	<u>Modest angina/exercise improvement with PCI</u> ; strong placebo effect
Serruys et al. (2012)	FFR-guided PCI reduced urgent revascularization and MI at 2 years
Boden et al. (2009)	<u>No significant mortality/MI difference in diabetics</u>
Pfisterer et al. (2001)	More symptom relief in <u>PCI group in elderly</u> ; no mortality/MI difference
Henderson et al. (1997)	Similar death/MI rates; early QoL benefit with PCI
Kimura et al. (2008)	<u>No difference in major events</u> ; some early angina benefit with PCI
Zellweger et al. (2007)	<u>No significant difference in death/MI</u> ; some silent ischemia benefit with PCI
Pitt et al. (1999)	Fewer ischemic events with PCI; short follow-up
Hueb et al. (2004)	Early angina/QoL improvement with PCI, no long-term difference
Hueb et al. (1998)	Some improvement in angina with PCI, no major outcome differences
Spertus et al. (2008)	QoL benefit early with PCI, not durable beyond 2–3 years
Stergiopoulos et al. (2014)	Meta-analysis: No mortality/MI benefit; repeat revascularization lower with PCI
Purnnani et al. (2012)	Meta-analysis: No difference in major outcomes
Hambrecht et al. (2004)	Early benefit for angina with PCI



The great paradox: Coronaropathy and the unsolved problem of sudden cardiac death



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SUDDEN DEATH

1 in 9 MEN will experience **SUDDEN CARDIAC DEATH**, most before age 70 years.



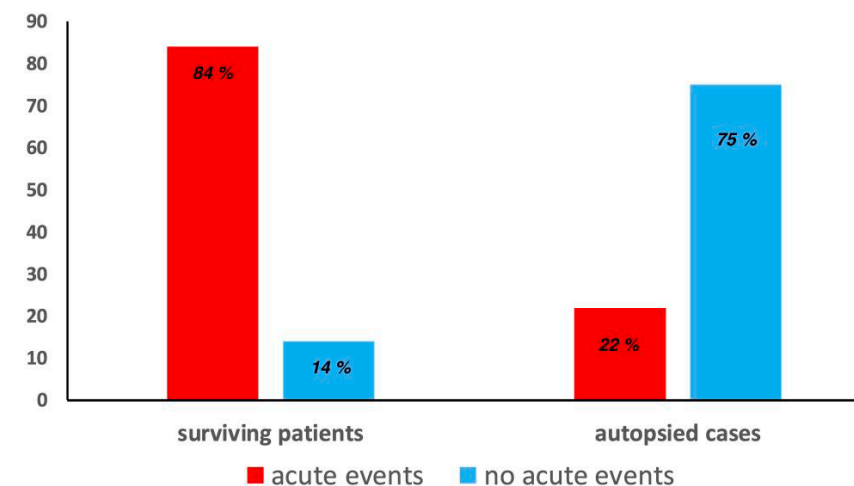
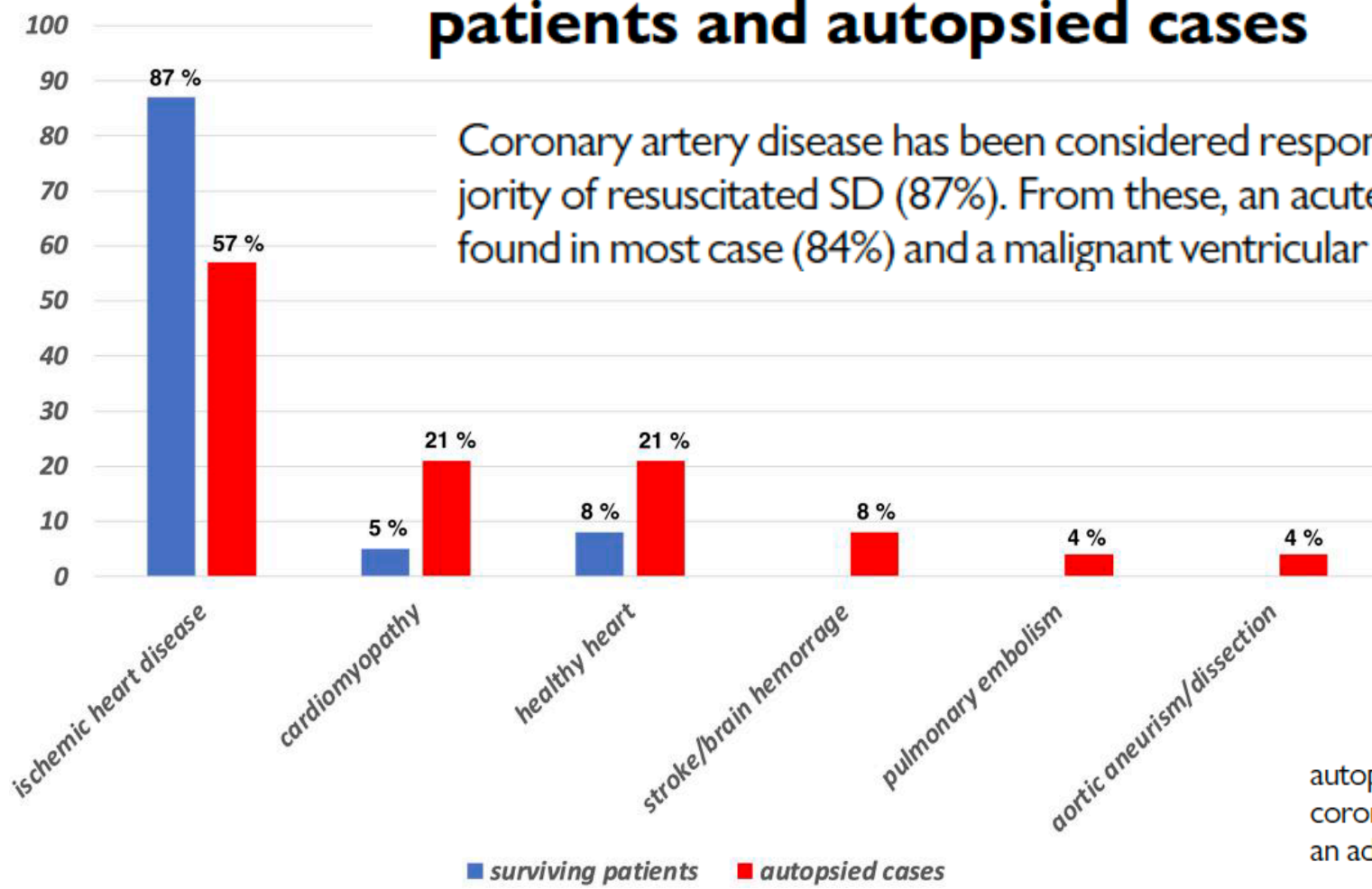
- About 1 in 30 women also have a higher lifetime risk of early death due to sudden cardiac death.
- Controlling cardiovascular risk factors, particularly high blood pressure, could reduce sudden cardiac death risks.



Source: Lloyd-Jones, et al., Lifetime Risk for Sudden Cardiac Death in the Community, Journal of the American Heart Association, June 29, 2016



Current causes of sudden death in large populations: differences between resuscitated patients and autopsied cases



autopsied patients, only half (48%) have been considered to be the result of coronary artery disease, with signs of acute coronary event in only 22% and an additional very small subset of other coronary artery abnormalities.

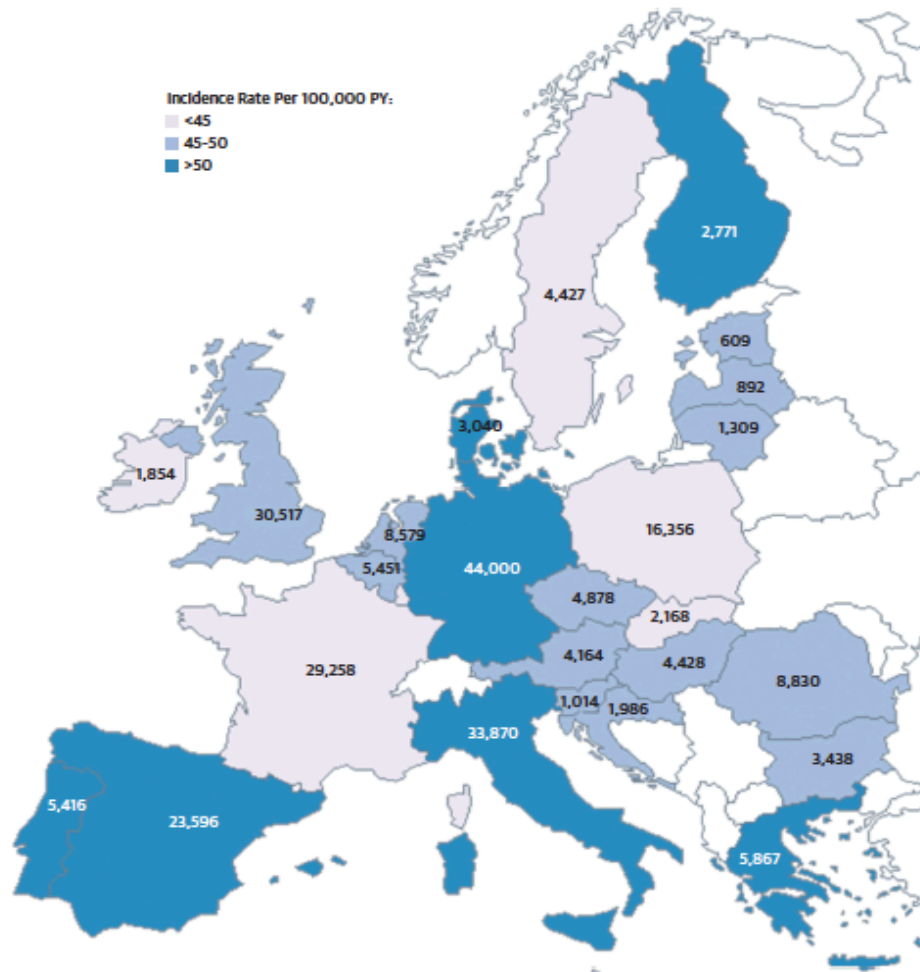
Incidence of Sudden Cardiac Death in the European Union



JACC VOL. 79, NO. 18, 2022

MAY 10, 2022:1818-1827

Jean-Philippe Empana, MD, PhD,^{a,b} Ivan Lerner, MD,^{a,b} Eugenie Valentin, MS,^{a,b} Fredrik Folke, MD, PhD,^{c,d}



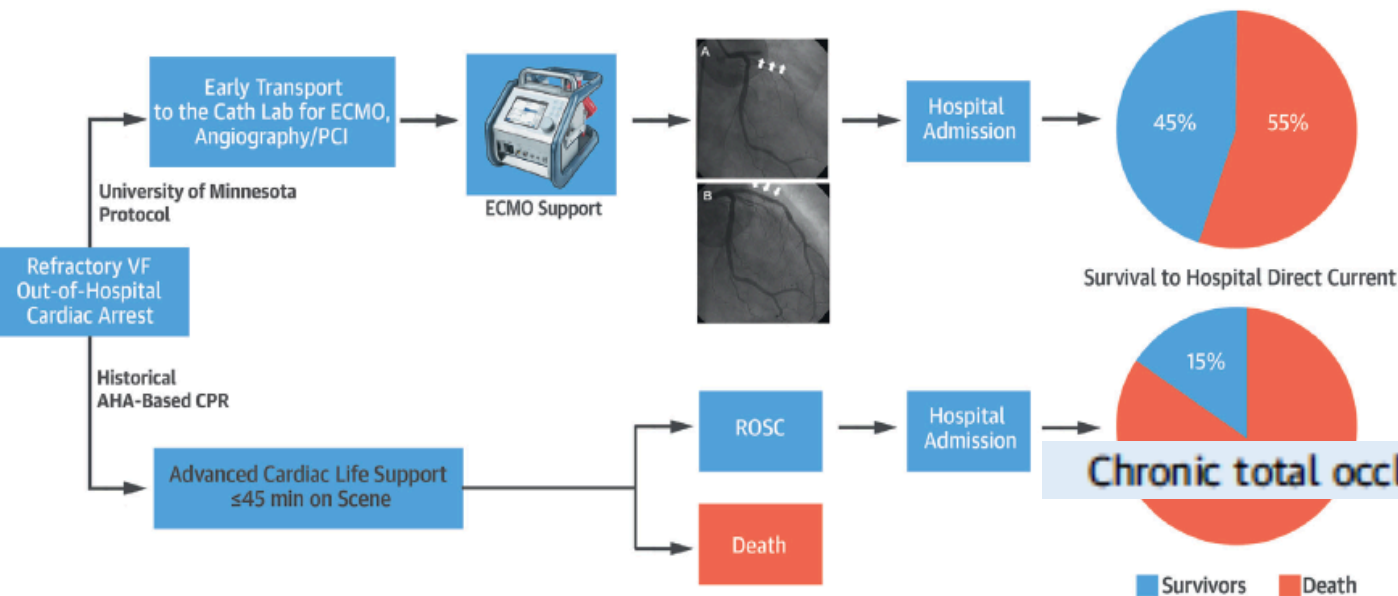
Remarkably, the incidence of SCD did not show any significant variations across years and centers.

well. The absence of such a trend in the present study supports the primary importance (although challenging) of identifying those individuals from the general population, where most SCDs occur, who are the most at risk of SCD.

We save the patients who reach the hospital but do not protect the patients who are at risk of sudden death

Coronary Artery Disease in Patients With Out-of-Hospital Refractory Ventricular Fibrillation Cardiac Arrest

Demetris Yannopoulos, MD,^a Jason A. Bartos, MD, PhD,^a Ganesh Raveendran, MD^a



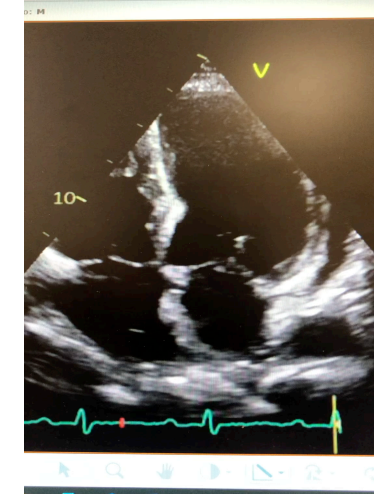
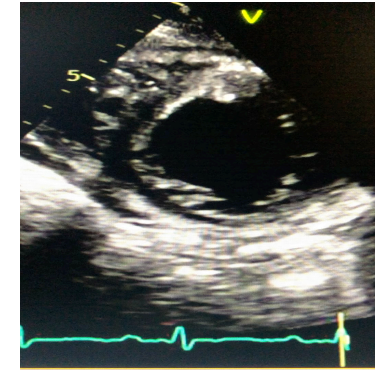
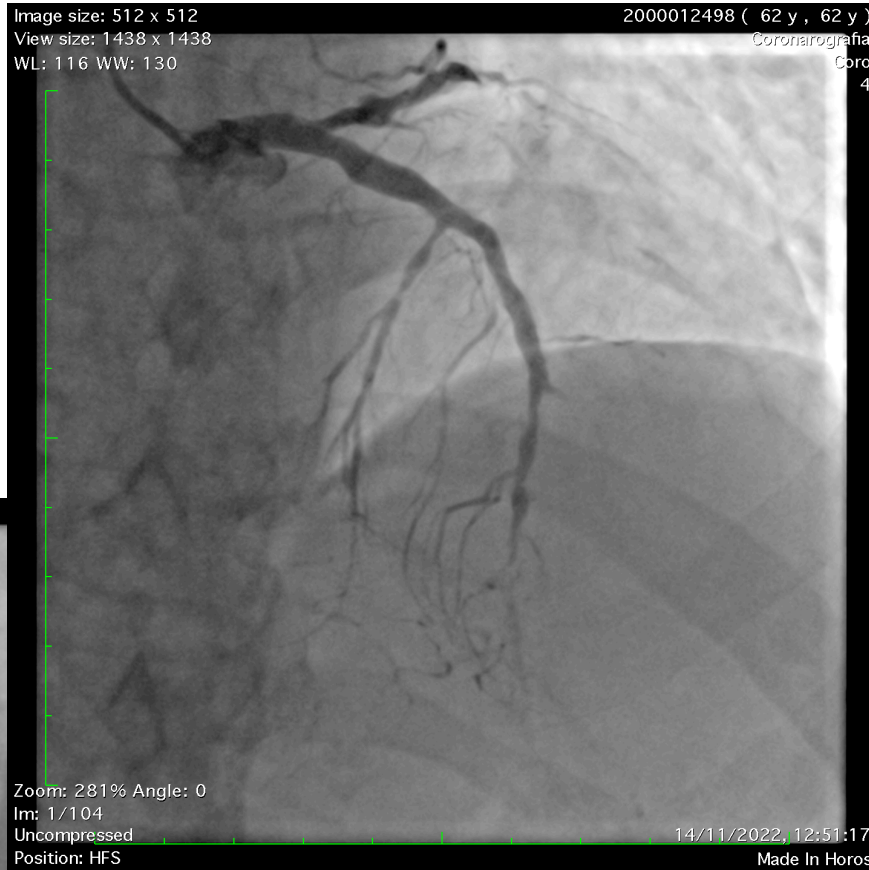
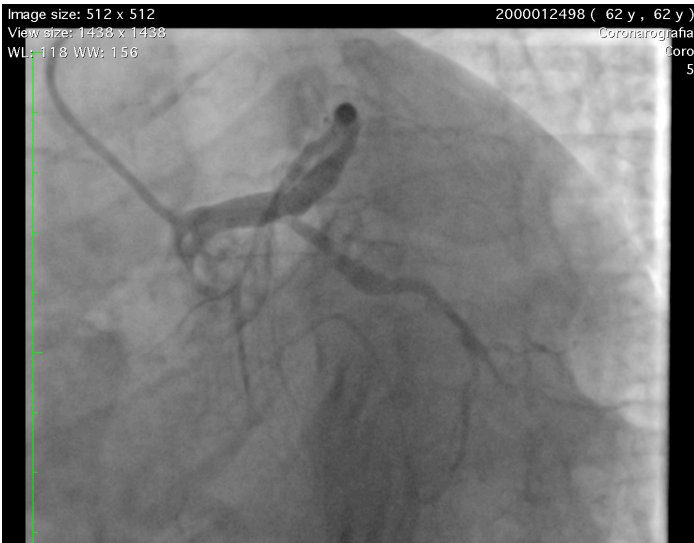
Angiographic findings

Normal or clinically insignificant CAD ($\leq 70\%$ stenosis)	9/55 (16)
Clinically significant CAD ($> 70\%$ stenosis)	46/55 (84)
Single-vessel disease	14/46 (30)
2-Vessel disease	12/46 (26)
3-Vessel disease	20/46 (44)
Disease location	
Left main	7/46 (15)
LAD	40/46 (87)
LCx	24/46 (52)
RCA	23/46 (50)
Prin coronary artery bypass graft	5/55 (9)
Chronic total occlusion present	18/55 (33)
Patients with acute thrombotic lesions	35/55 (64)
Patients with chronic disease	33/55 (60)
Acute on chronic lesion	23/55 (42)

SYNTAX score

29.4 ± 13.9

62 y M, EF 25%



The obsolete clinical dogma of ischemia and vitality research

ORIGINAL RESEARCH ARTICLE



Circulation

Outcomes in the ISCHEMIA Trial Based on Coronary Artery Disease and Ischemia Severity

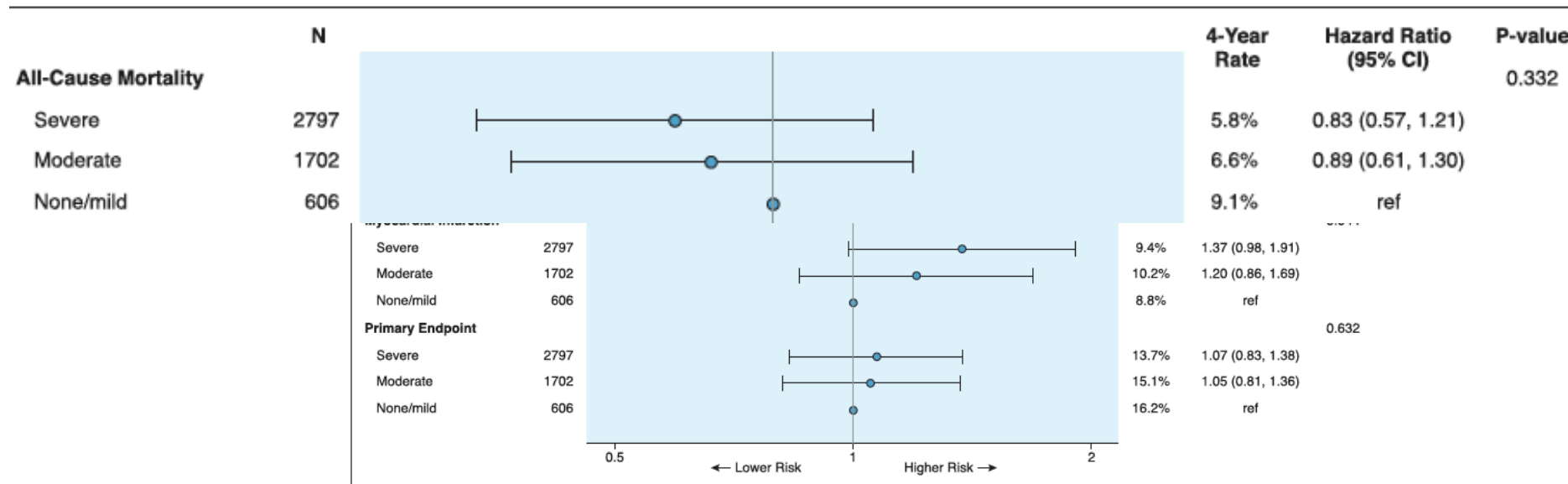
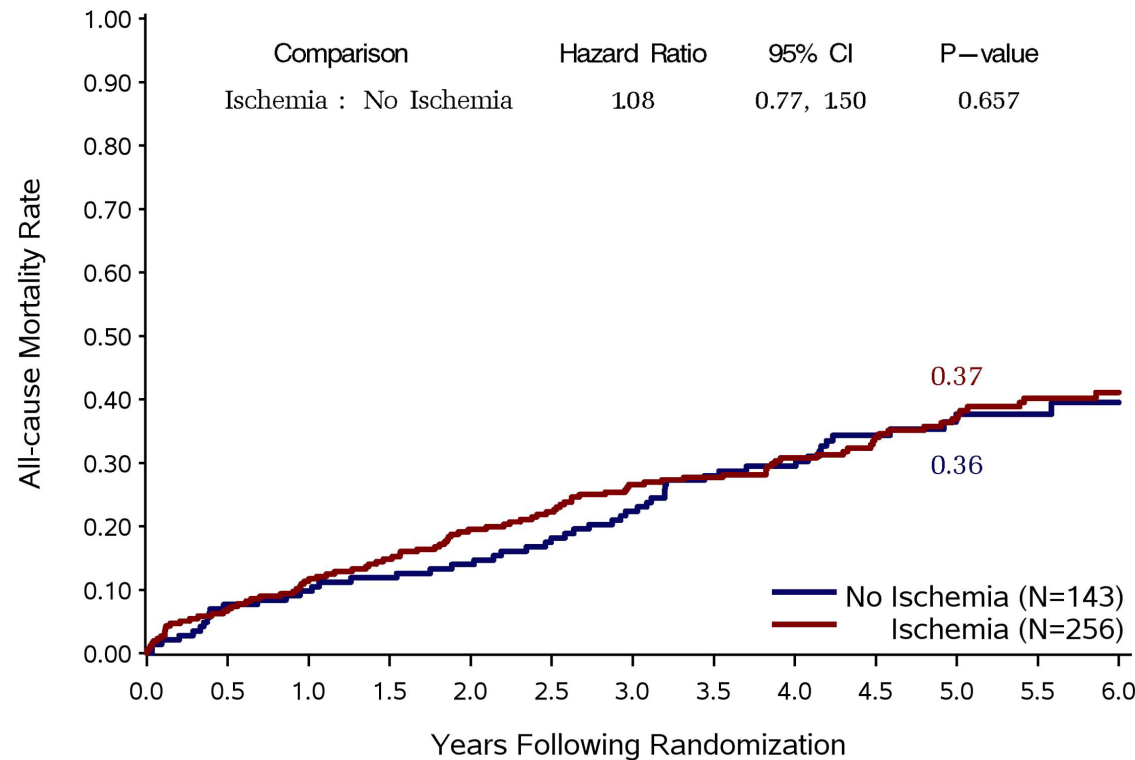


Figure 1. Association between ischemia severity and outcomes.

“In ISCHEMIA, ischemia severity was not associated with all-cause mortality. There was no prognostic gradient across ischemia categories.”

Inducible Myocardial Ischemia and Outcomes in Patients With Coronary Artery Disease and Left Ventricular Dysfunction



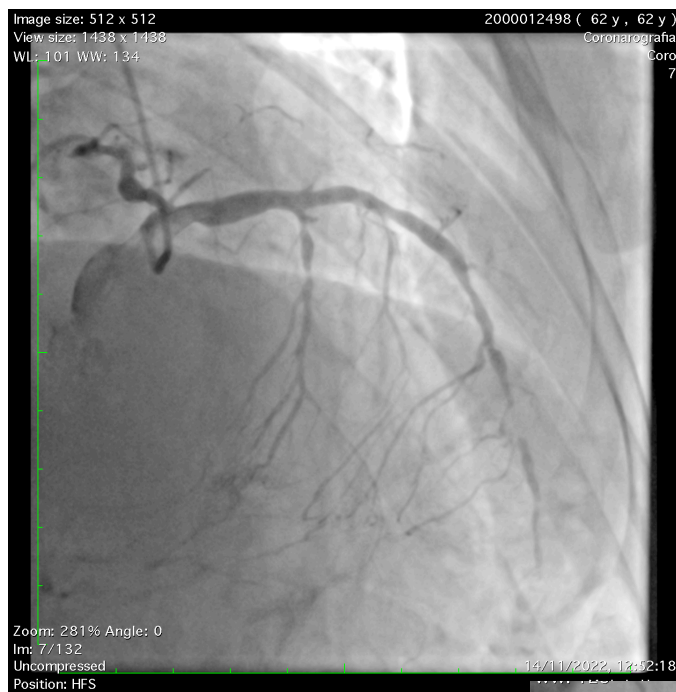
STICH ischemia substudy

Patients at Risk:							
No Ischemia	143	129	123	111	91	52	24
Ischemia	256	227	207	188	147	100	57

Predicting Outcome in the COURAGE Trial

Conclusions

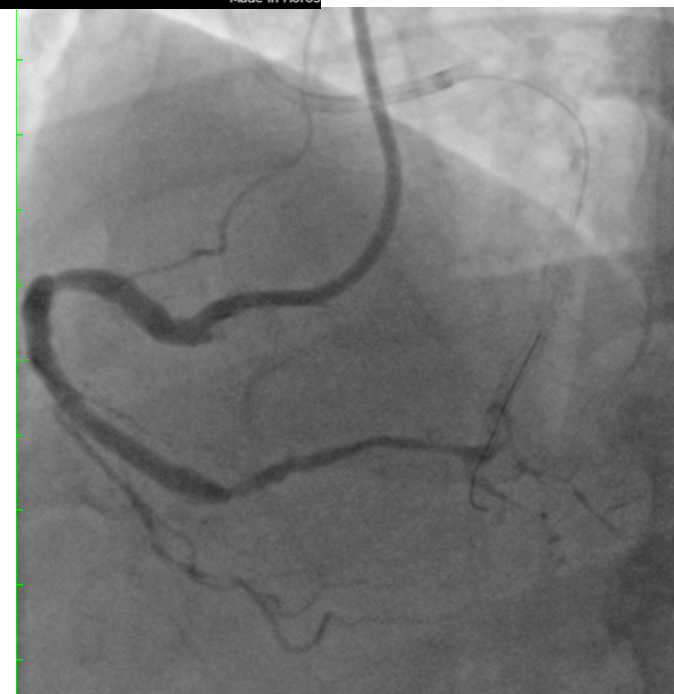
In patients treated with OMT with or without elective or symptom-warranted PCI, anatomic burden of coronary disease, but not ischemic burden, predicted the risk of death,



PRE

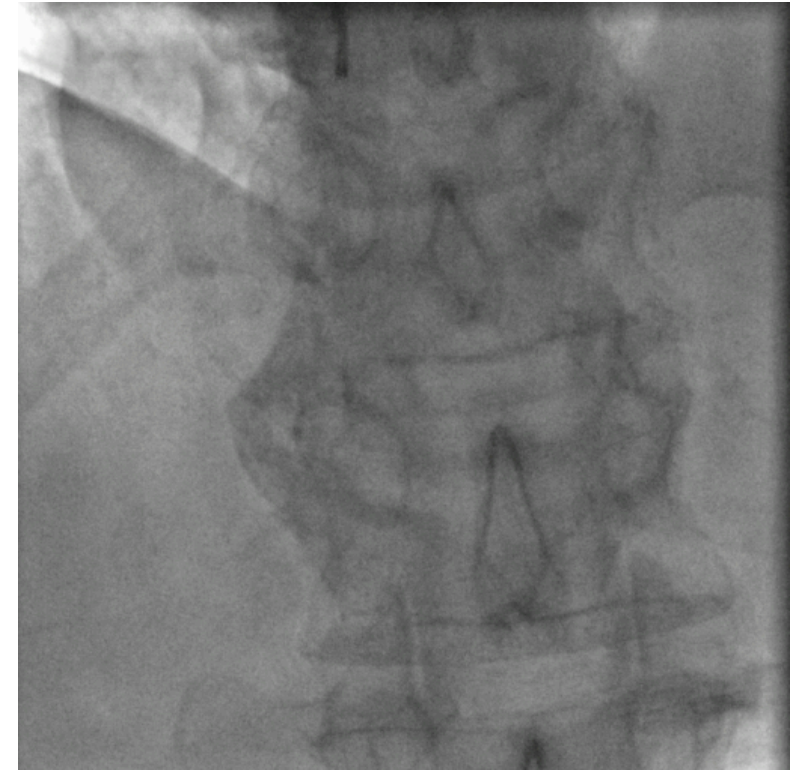
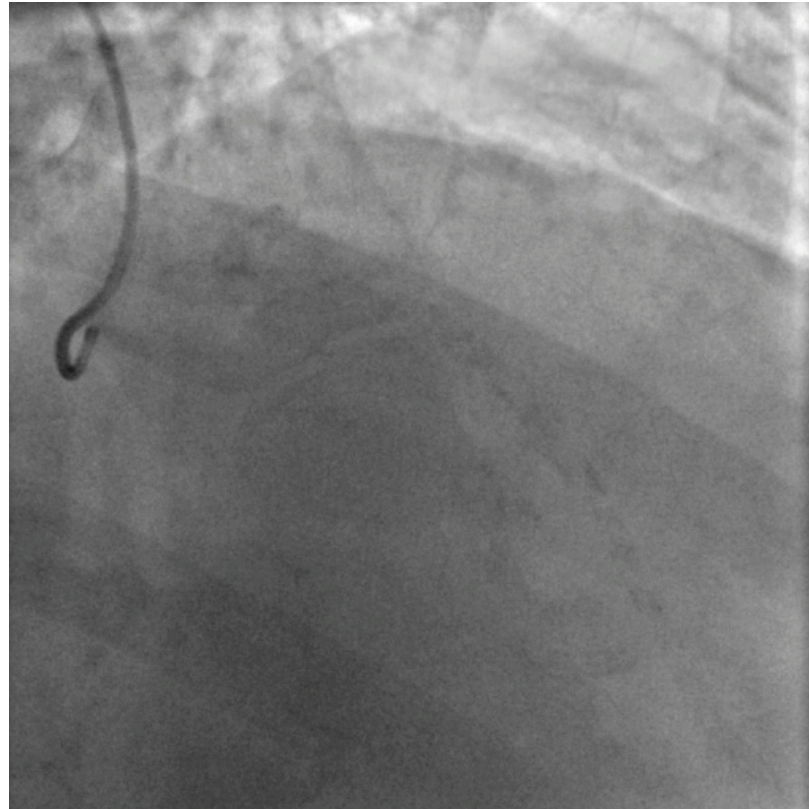


POST



The case that forced me to rethink everything

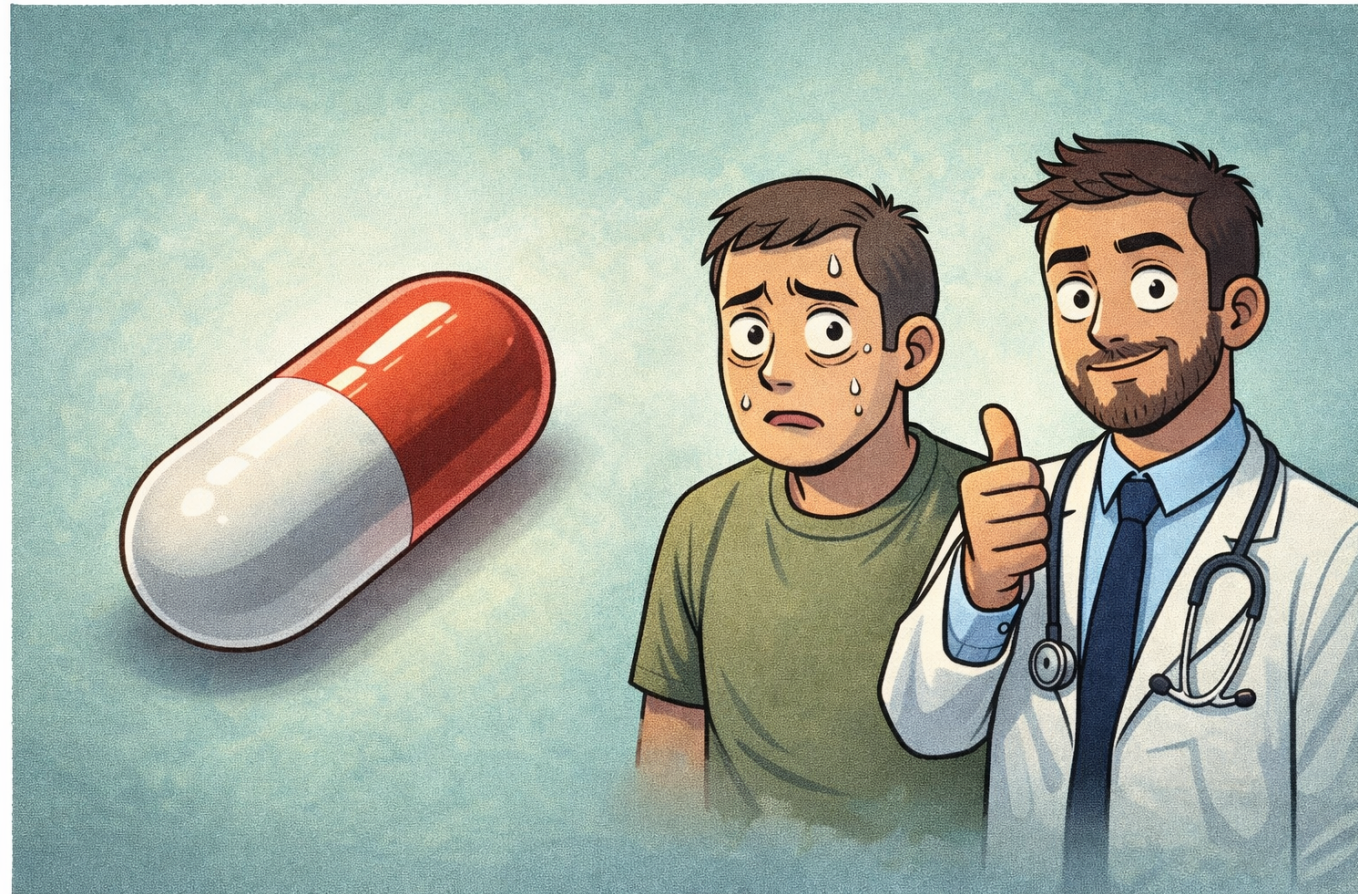
64-year-old male, trivessel disease, ECG stress test +
deemed not suitable for revascularization by both the
interventional cardiologist and the cardiac surgeon



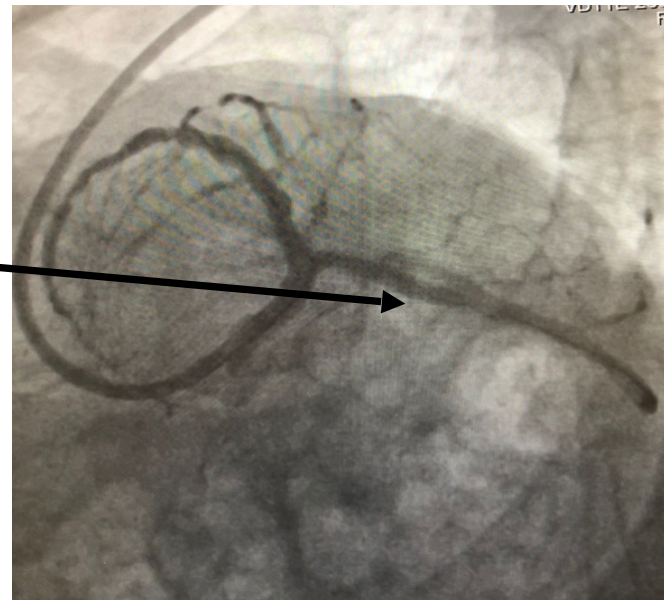
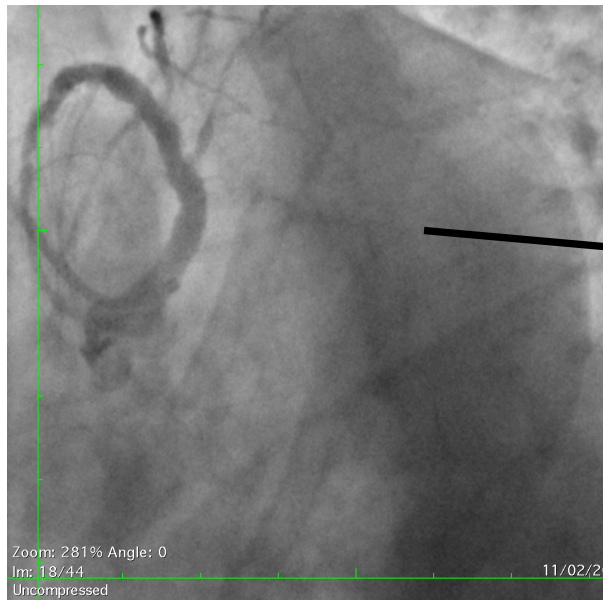
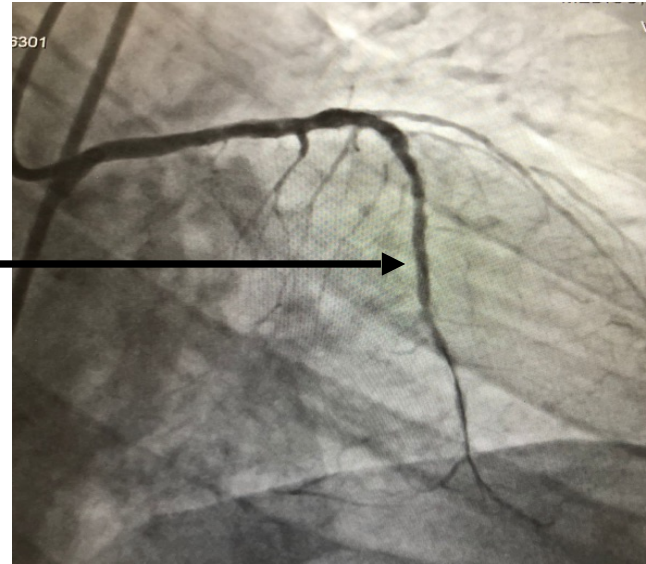
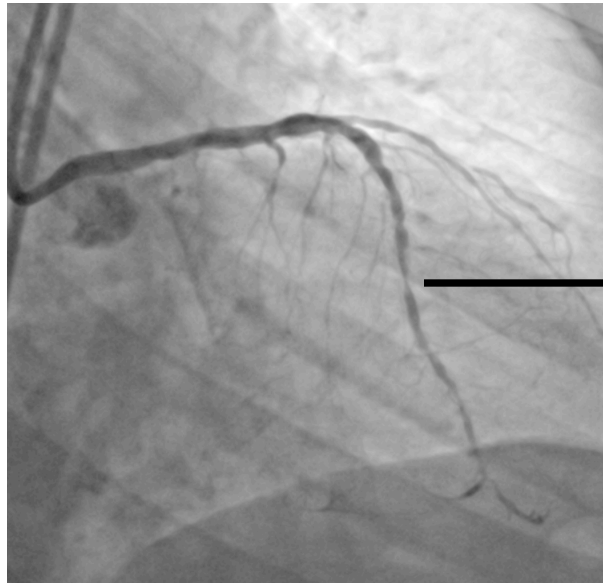
**His twins brother died suddently the previous year few mount later the discover the same complex cronary disease and as him was destinated to medical therphy
Déjà vu?"**

He came to my attention and said «I don't trust of them, my brother died after that decision, I want the revascularizzation

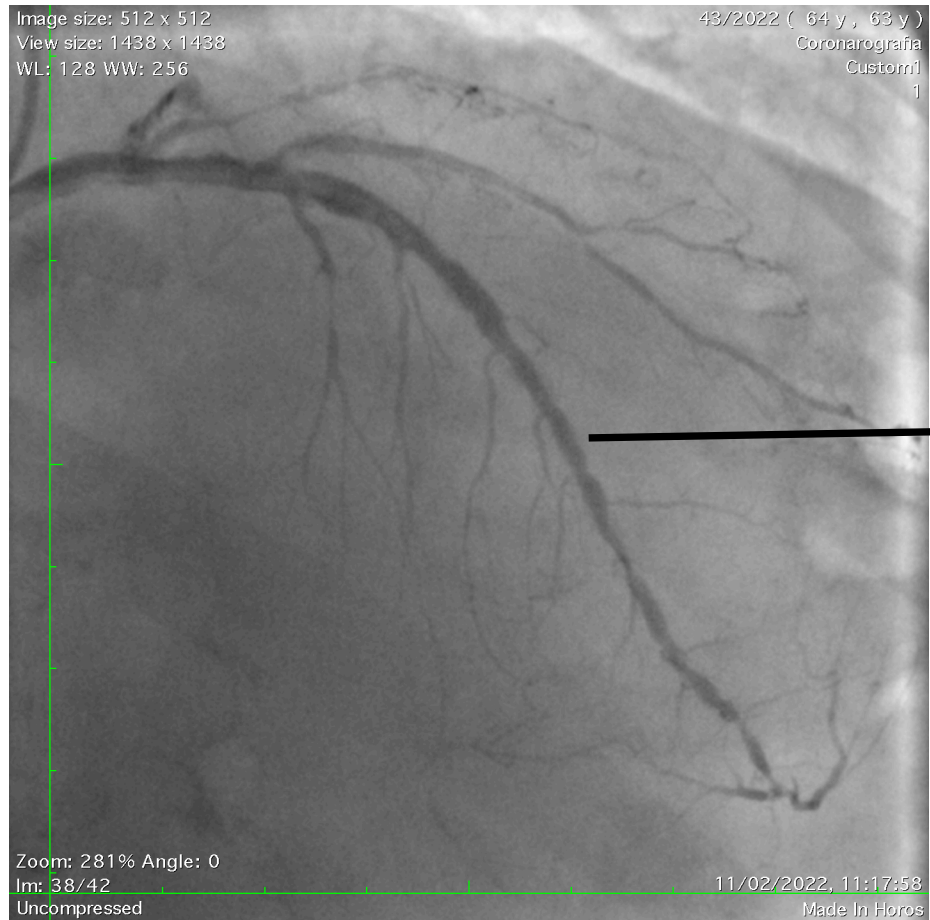
...



LCX CTO endend with mini crush on the LM and spot stent on LAD subocclusive pre apical stenosis

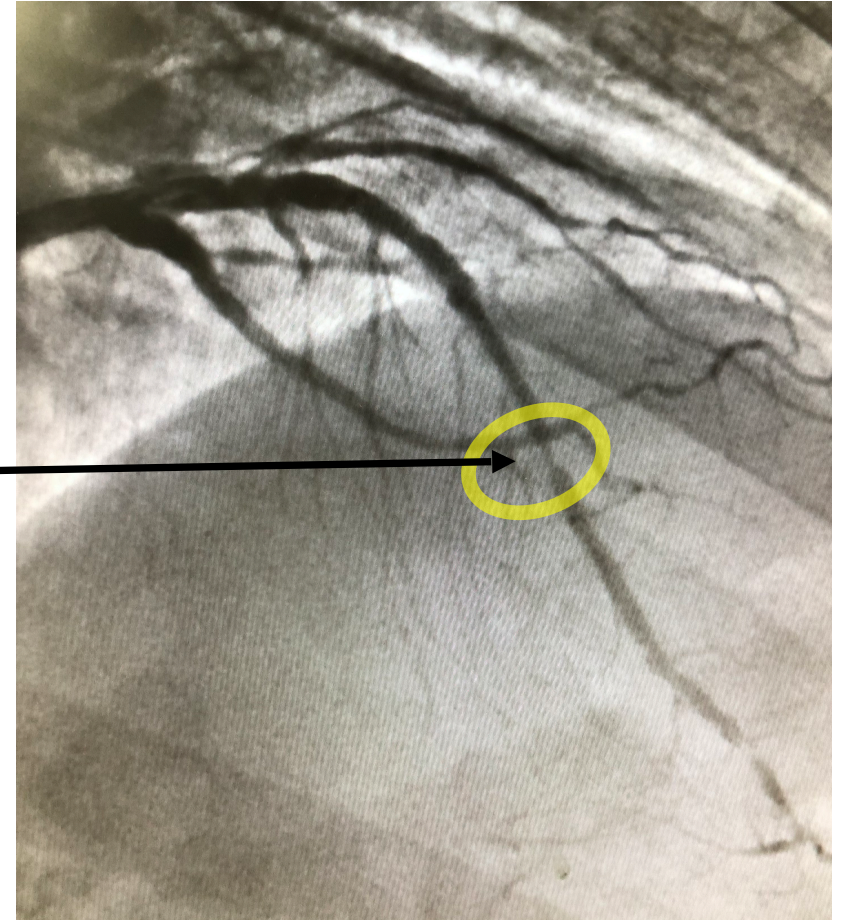


12 months later the patient presented with acute coronary syndrome



The event involved
an unsuspected
position

What would have
happened if the
circumflex artery
was still close?



Whit that decision he saved his own life

The prognostic impact of CTO-PCI

Does Global burden of coronary atherosclerosis modify the prognostic impact of CTO-PCI?



ESC

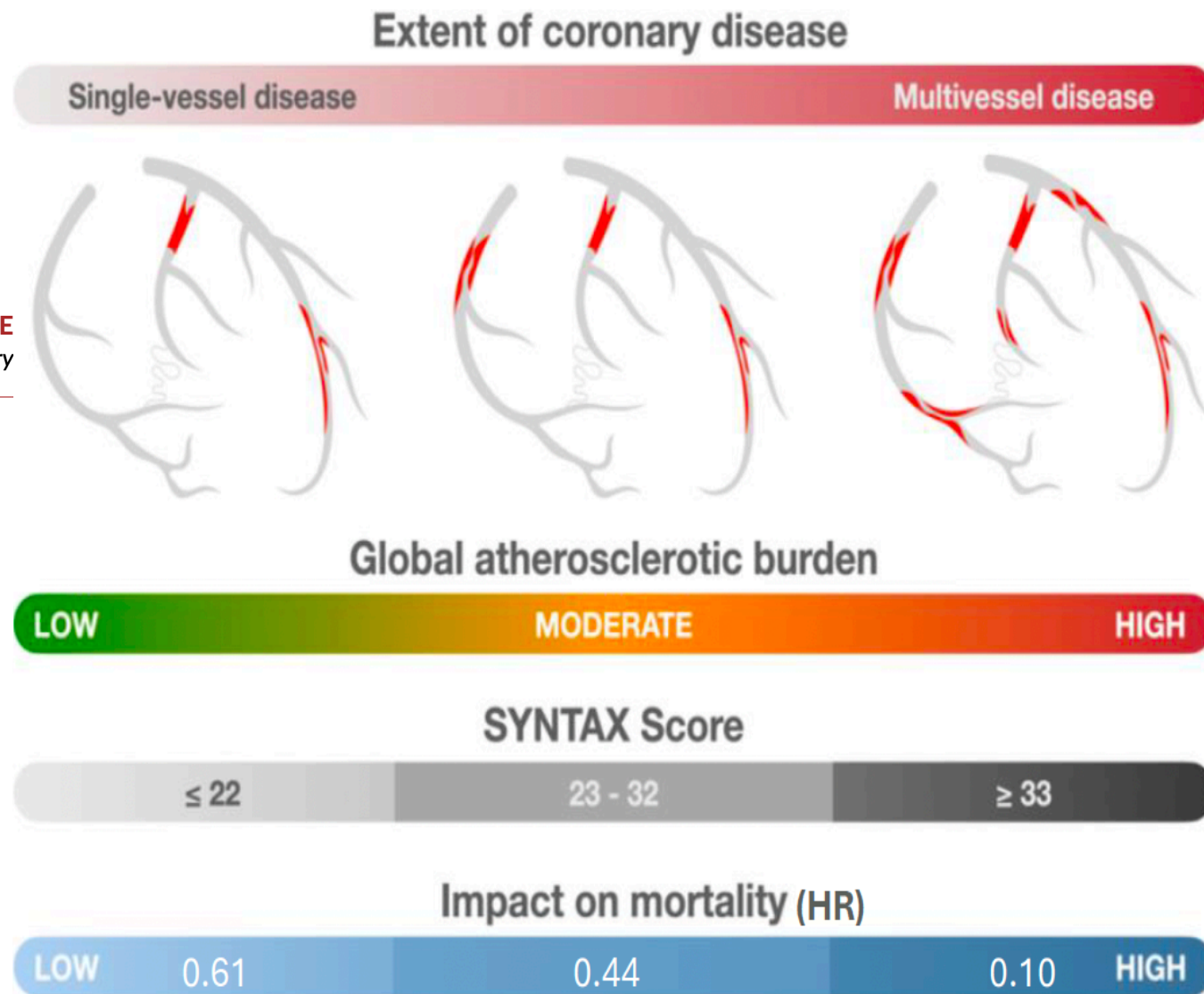
European Heart Journal Open (2026) 6, oeag045
<https://doi.org/10.1093/ehjopen/oeag045>

ORIGINAL ARTICLE

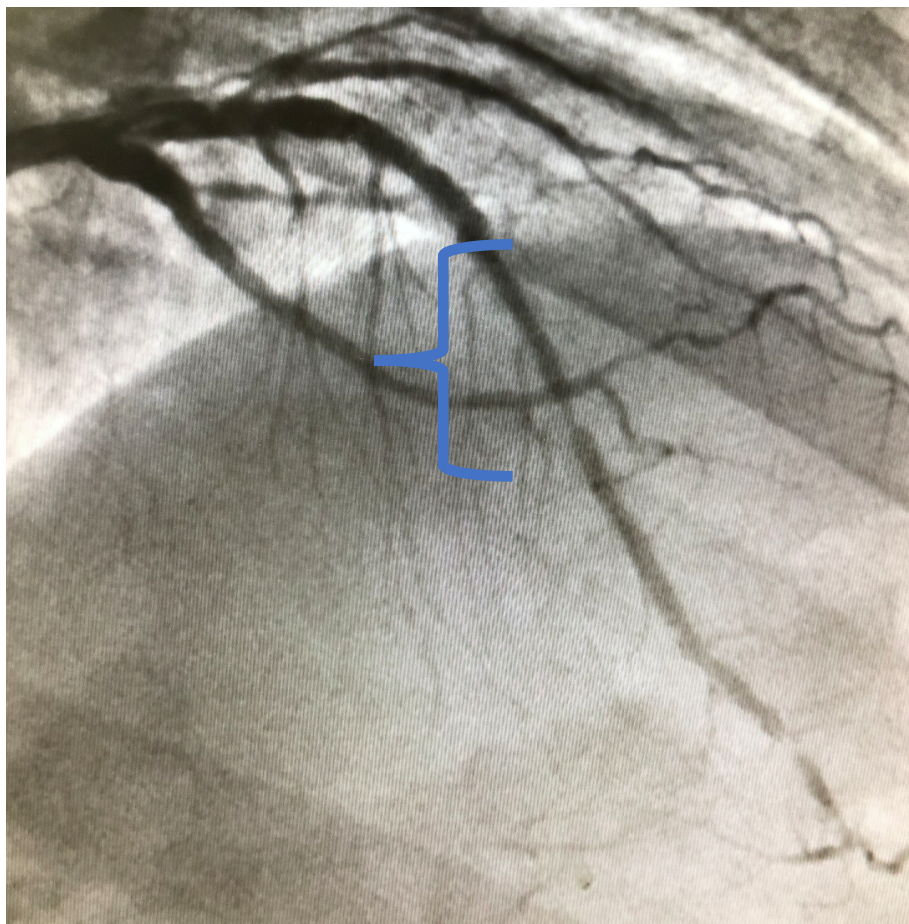
Interventional Cardiology and Cardiac Surgery

Overall coronary disease burden modifies the prognostic benefit of CTO-PCI: a SYNTAX score-stratified meta-analysis

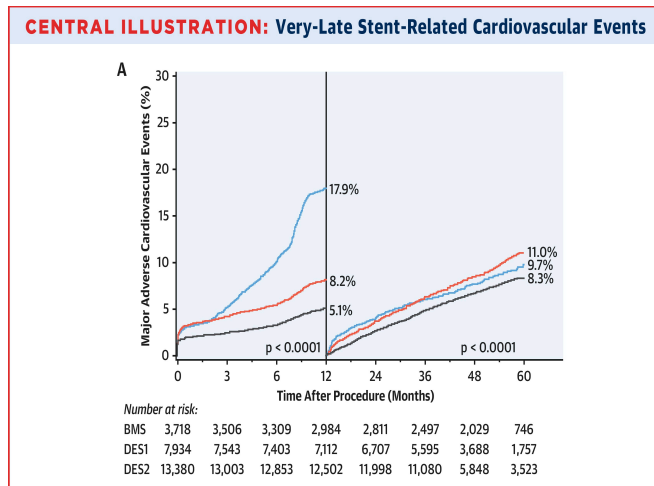
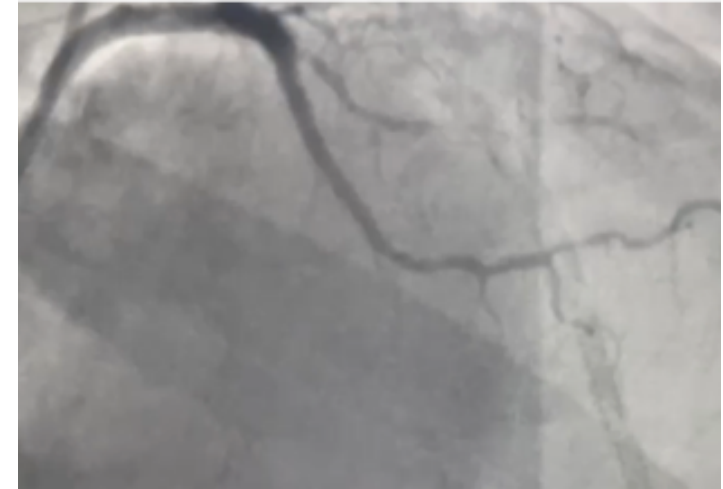
Nino Cocco ^{1,*}, Kambis Mashayekhi ², Agostino Spanò¹, Michael Behnes ³,



But an other long stent was added at that time 3x26 to cover all the disease



3 y later the patient presented with **acute coronary syndrome for stent thrombosis after discontinuation of antiplatelet therapy for biopsy**



Something need to change if we want to treat patient at higher risk of death

Study Design & High-Risk Criteria

Study setup

Single-center, retrospective

Campus Bio-Medico University Hospital

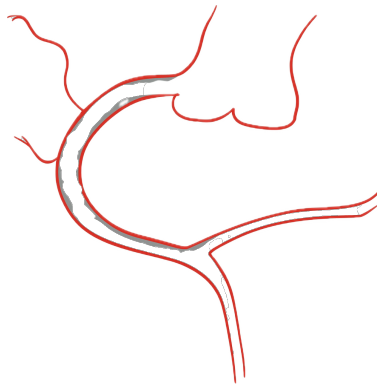
April 2024 – August 2025

Inclusion: consecutive CTO PCI

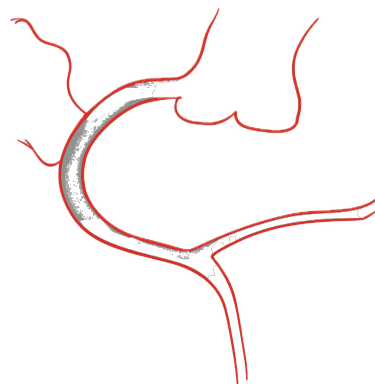
High Risk for Stent Failure (HR-SF)

≥ 2 of the following anatomical features:

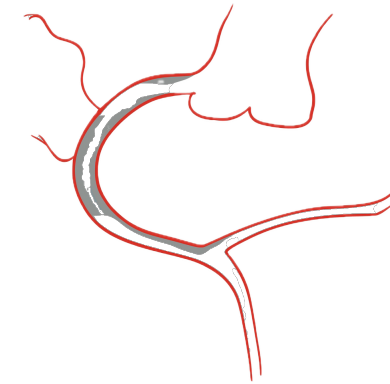
- Severe calcification
- Marked tortuosity ($> 45^\circ$)
- Bifurcation with side branch ≥ 2.5 mm
- Distal vessel disease (< 2.5 mm or diffuse)
- Lesion length > 60 mm



Acceptable/good result
Residual stenosis $< 50\%$
and/or TIMI III



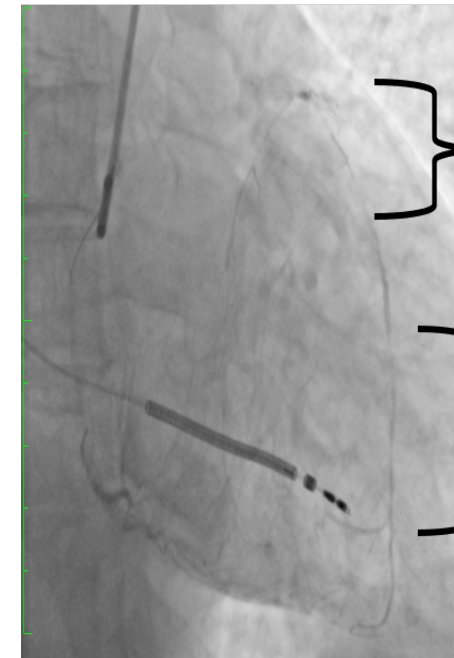
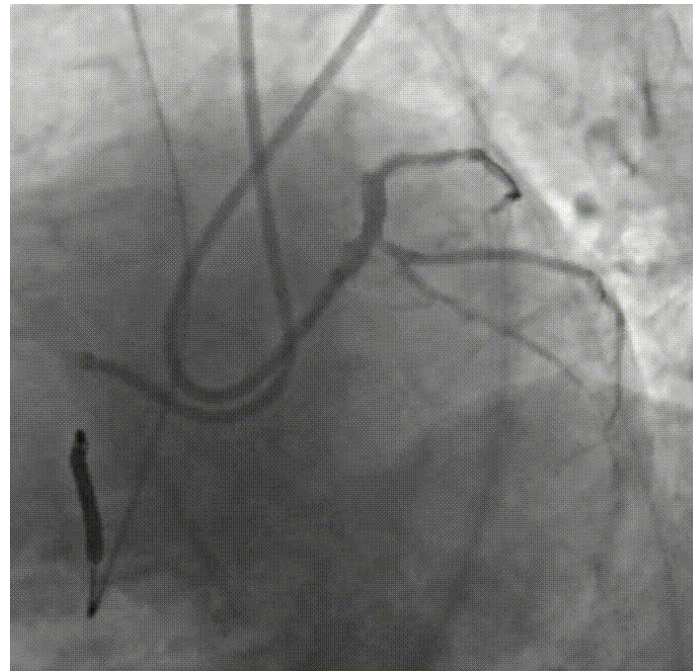
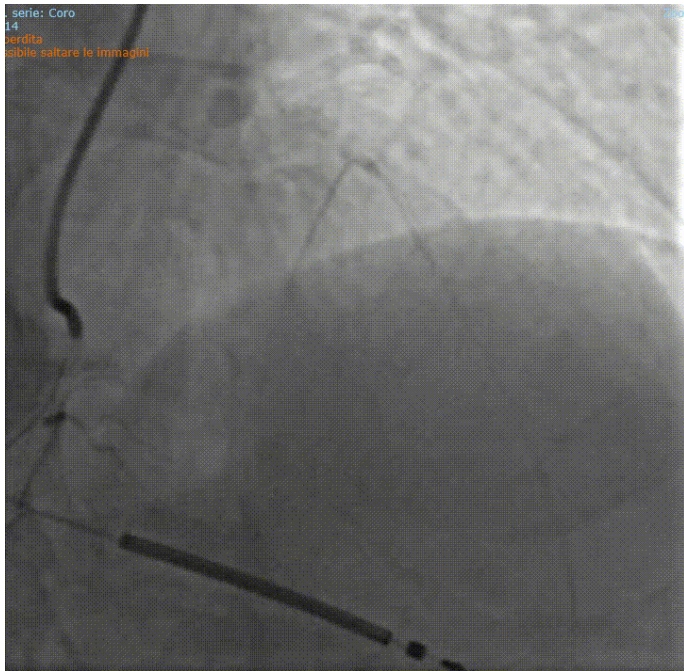
Sub-optimal result
Residual stenosis $50-70\%$
and/or TIMI II-III



Poor result
Residual stenosis $> 70\%$
and/or TIMI 0-I

The First Case

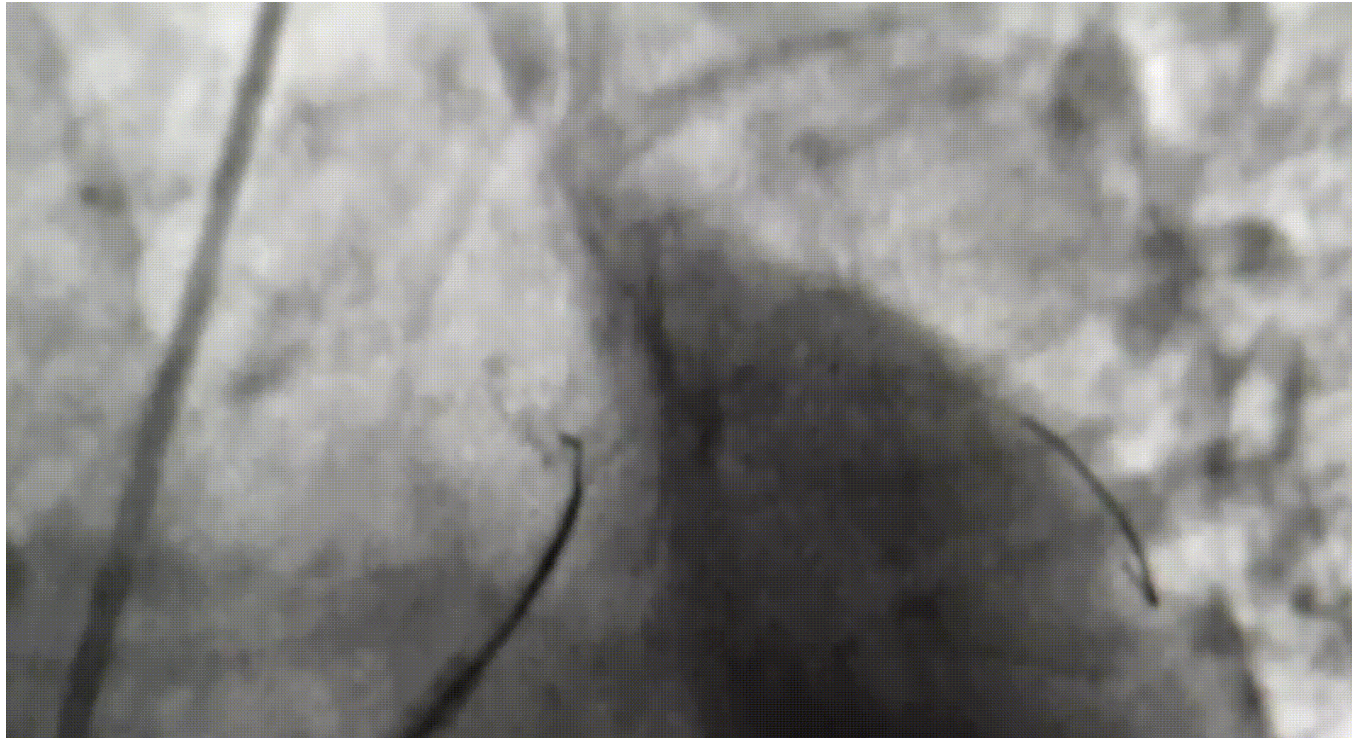
- Male 53 years old, hypertension, hyperlipidemia. Severe COPD
- 2018 ACS-NSTE in MVD - PCI of first marginal branch and ostial first diagonal branch. June 2023 admission for heart failure, angina (CCS –II) and SVT. TTEcho: LVEF: 25-30%. – ICD implantation.
- Coronary angiogram: mid LAD CTO. August 2023 stress-echo documented myocardial viability.
- Heart team evaluation
- October 2023 - persistence of symptoms on OMT - attempt of CTO PCI of LAD



Long and severe stenosis involving the mid and distal part

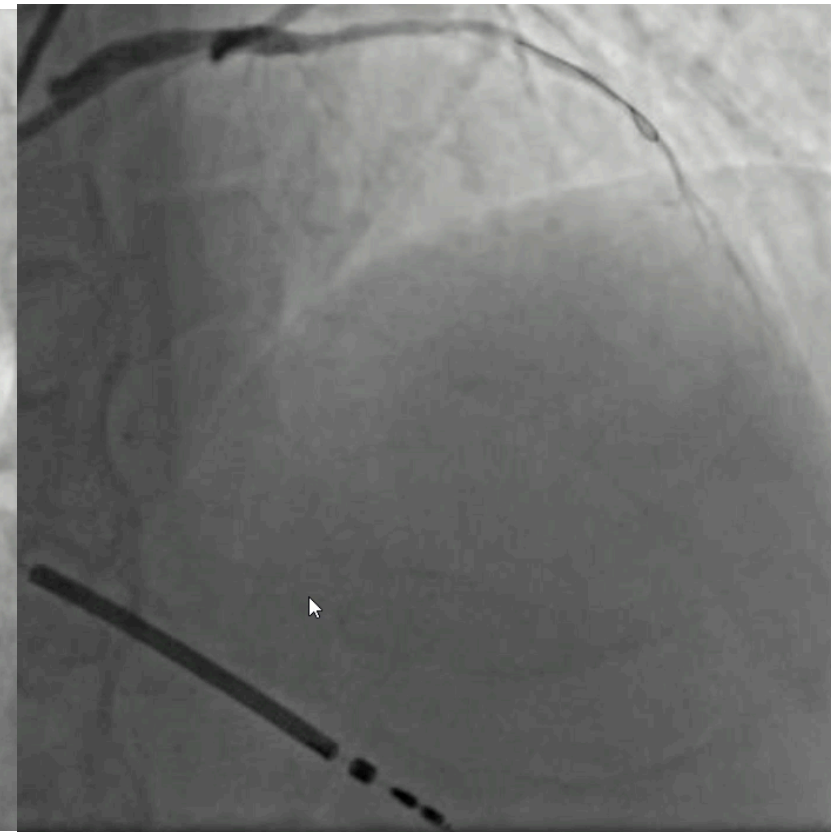
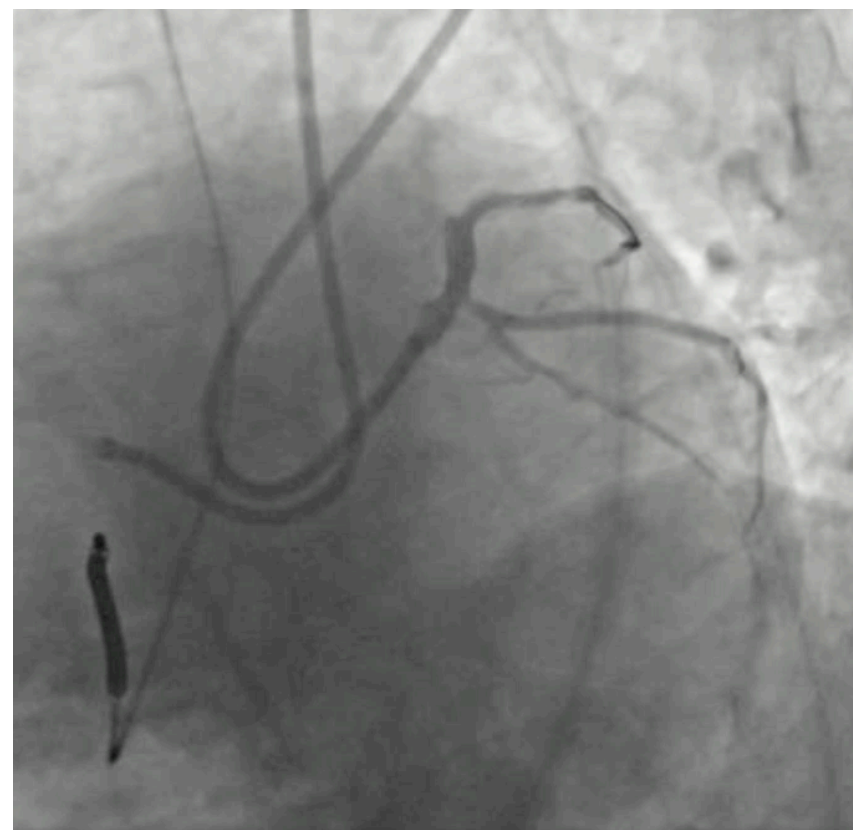
Severe and diffuse disease of the apical tract

- Antegrade approach
- Cap puncture: about 60° angle in respect of diagonal branch
- Lot of friction in advancing conventional microcatheter
- Stent struts protruding too much in LAD

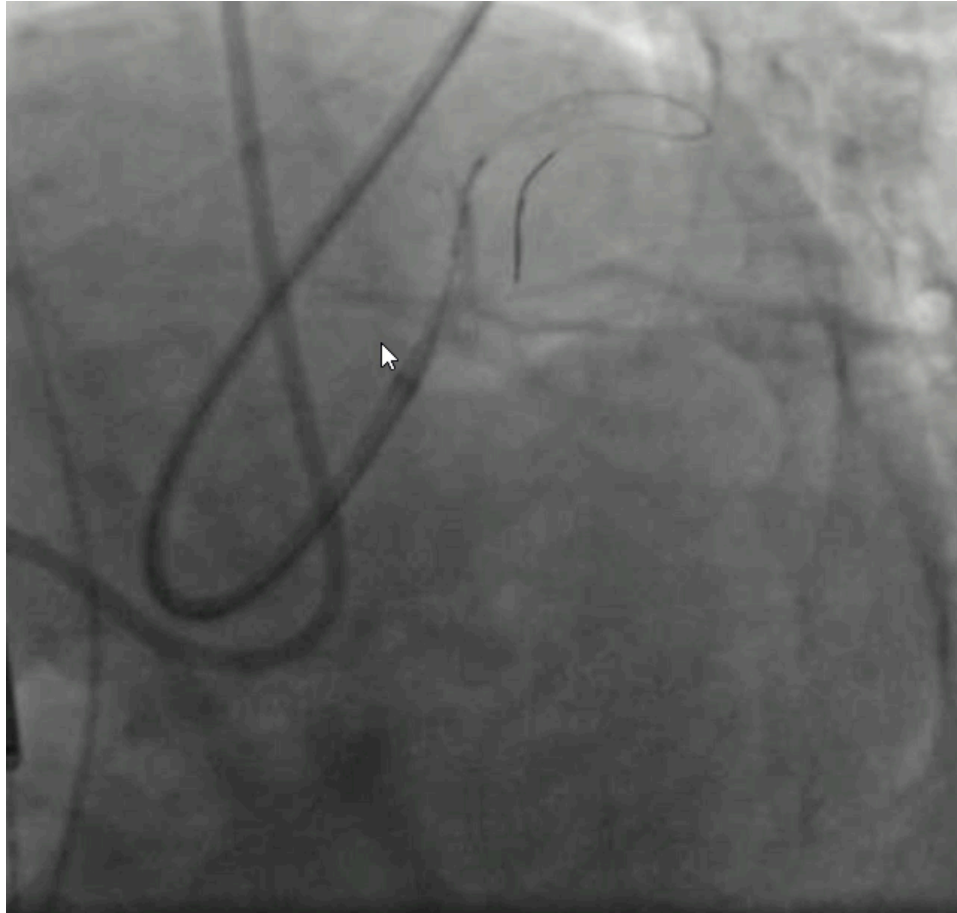


- EKG modification
- Chest pain onset
- Mild In-stent thromobosis

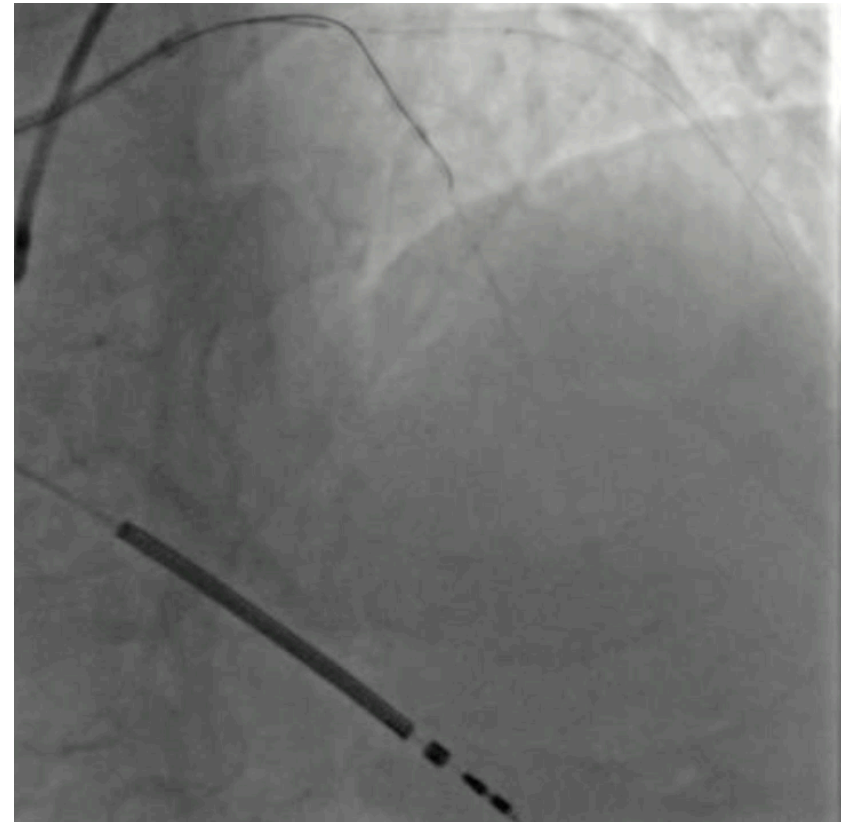
Second attempt



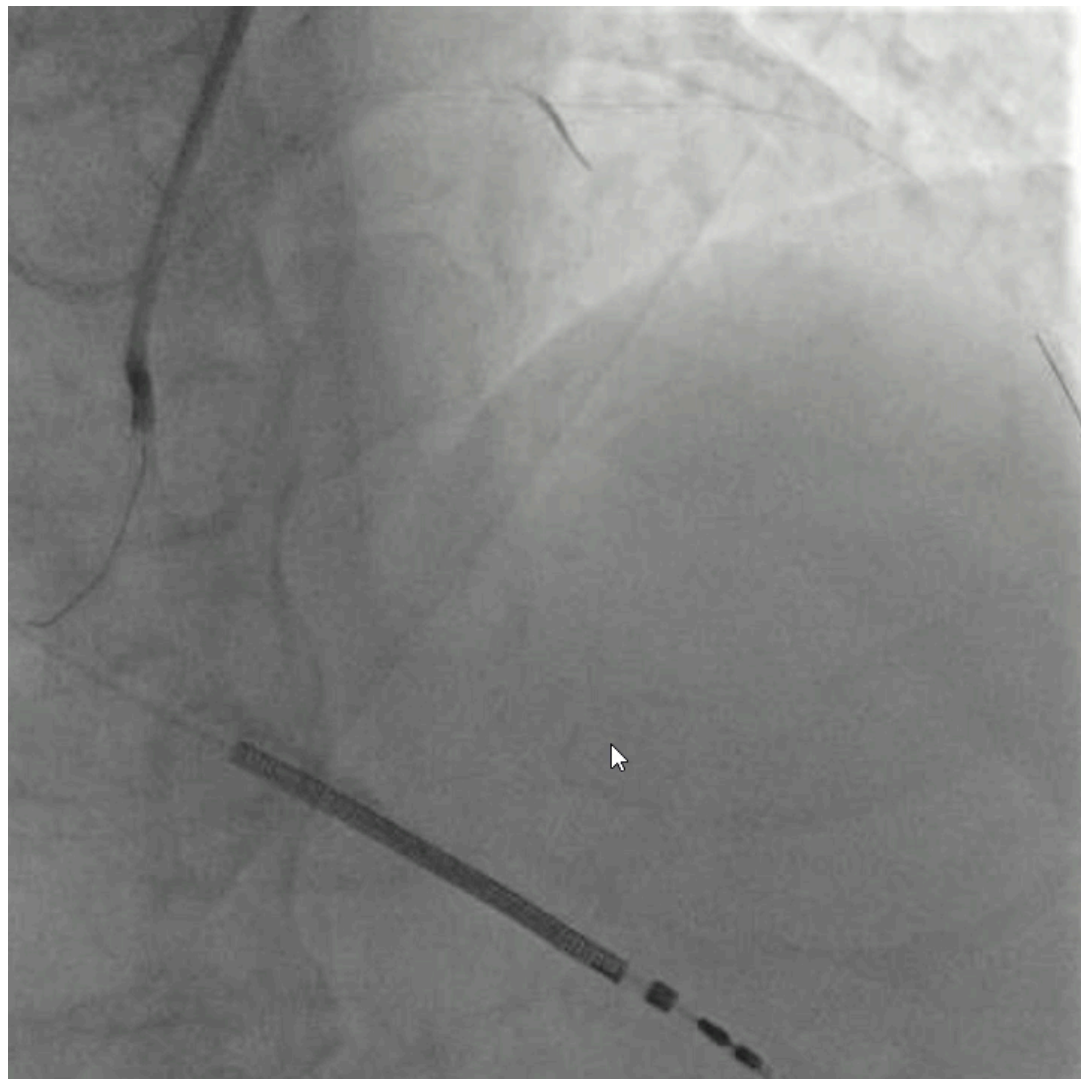
Wire in diagonal in U fascion
Recross microcatheter



Puncture of the cap wit Conquest PRO 12



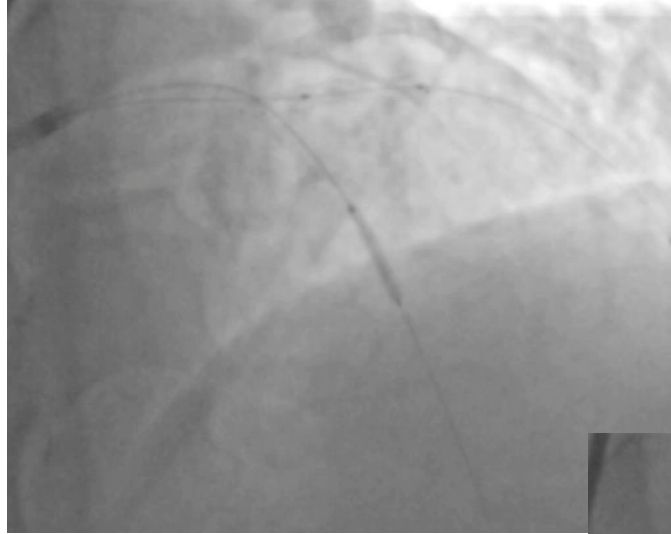
Reentry with gaia third



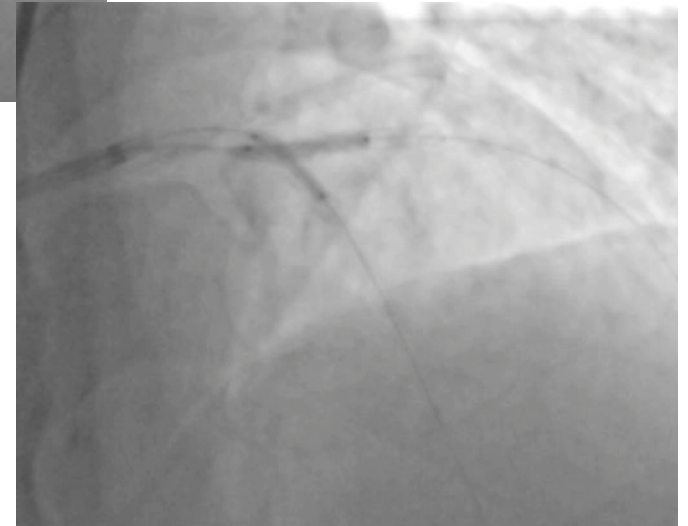
Intraluminal wire position confirmation

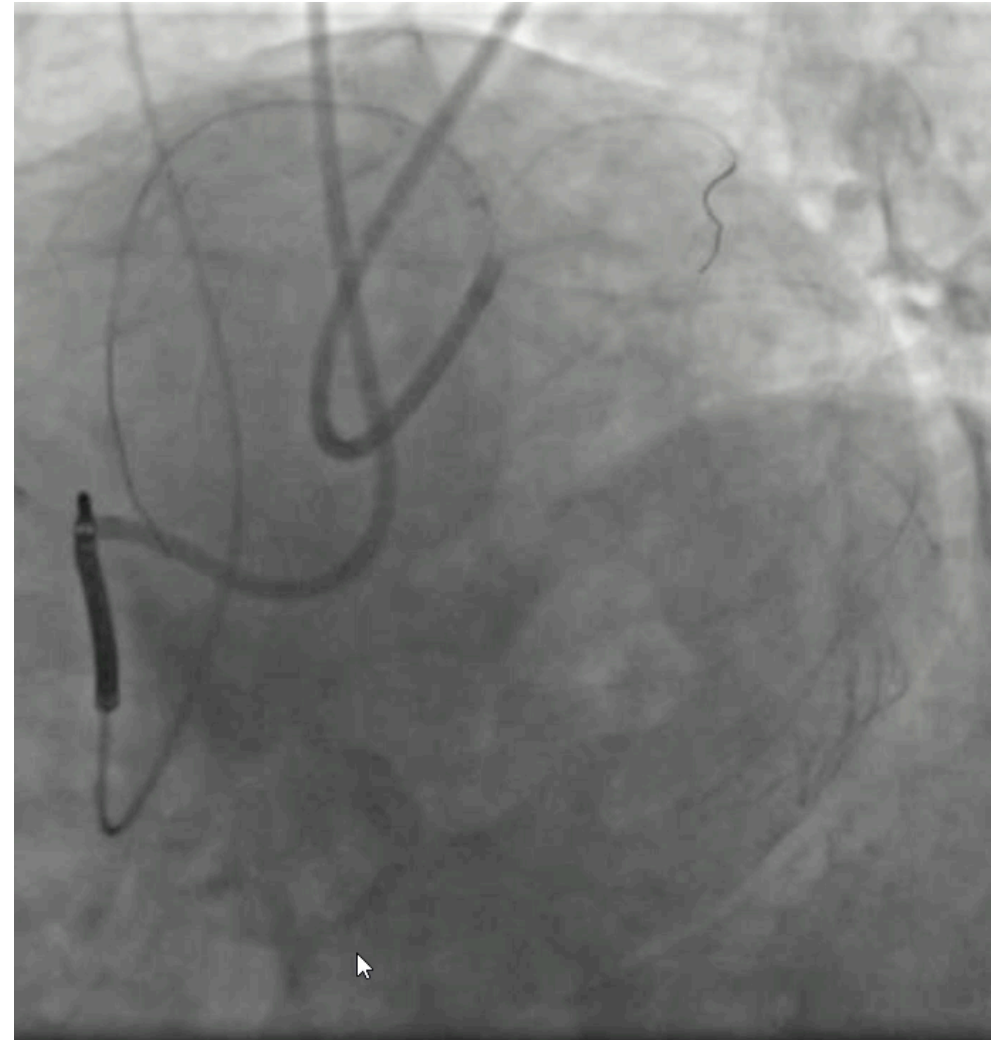
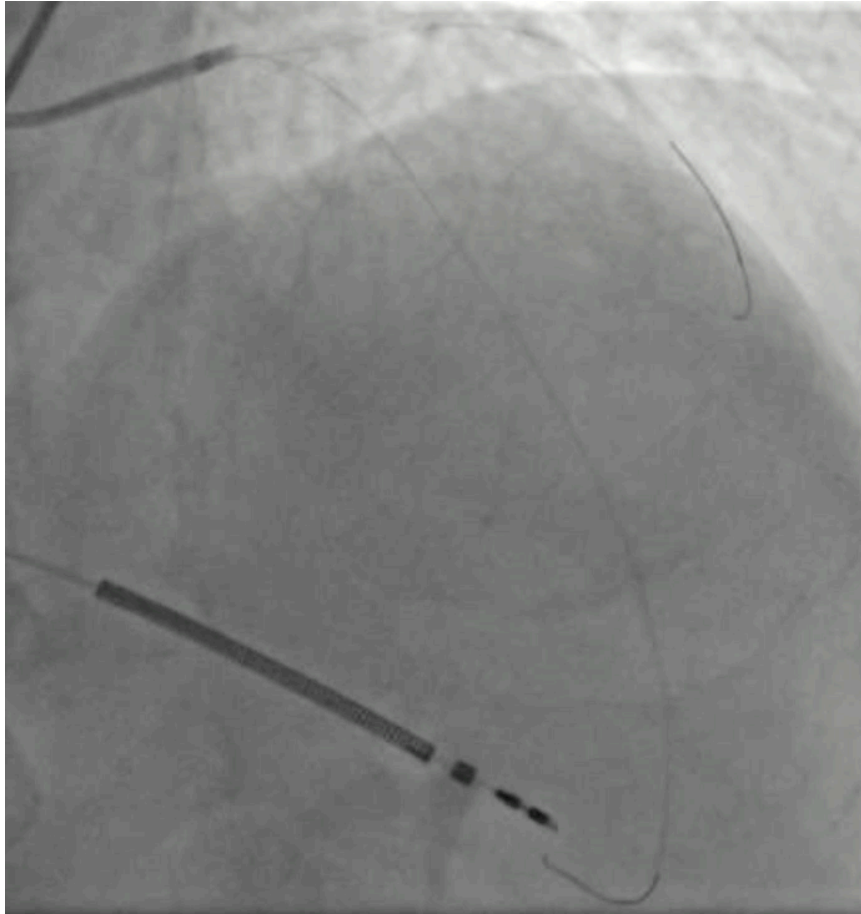


NC 2 and 2,5x20 predilatation
with **anchoring balloon**
technique (3x15 in diagonal)

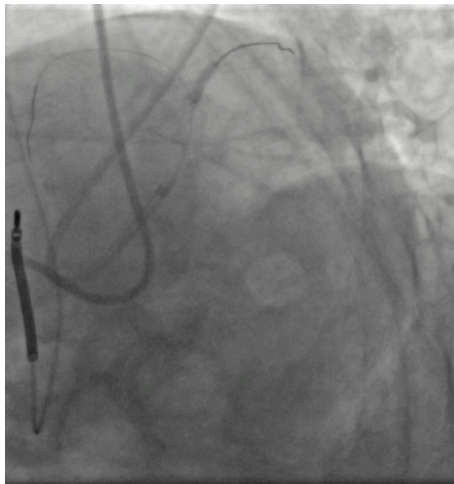


Kissing NC 2,5x20





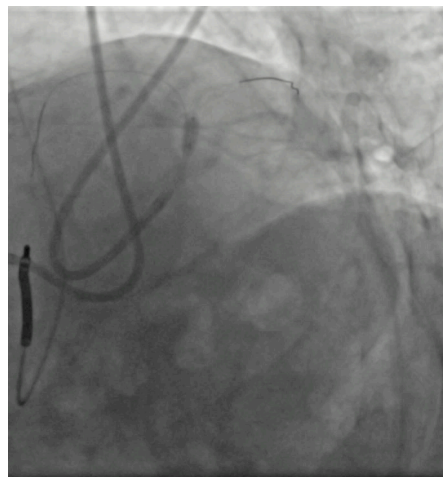
NC 3x15



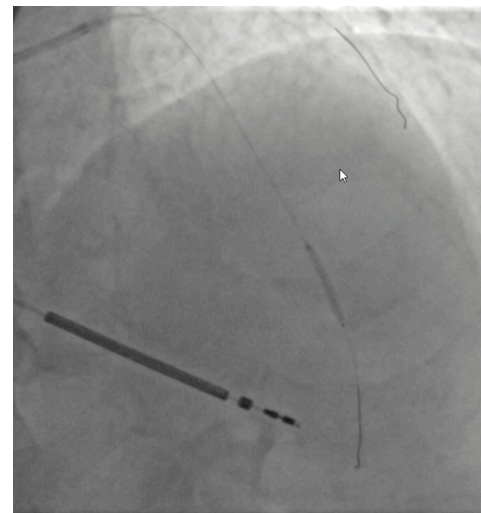
Kissing NC 3x15 and DEB



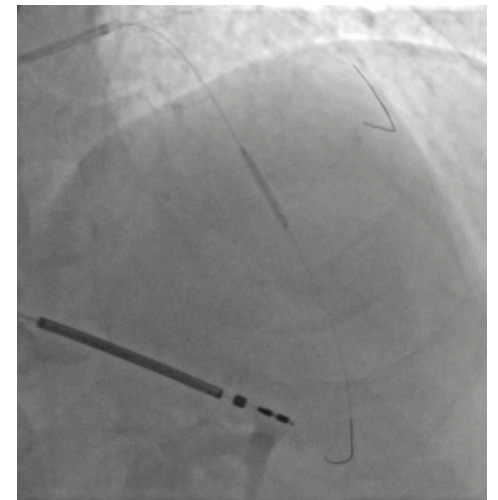
POT 4x8



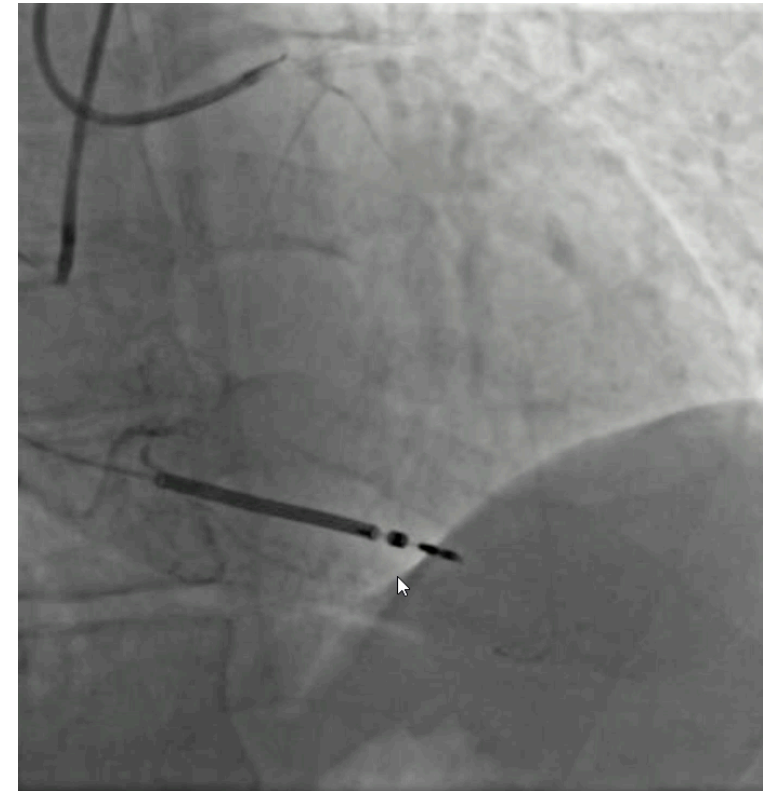
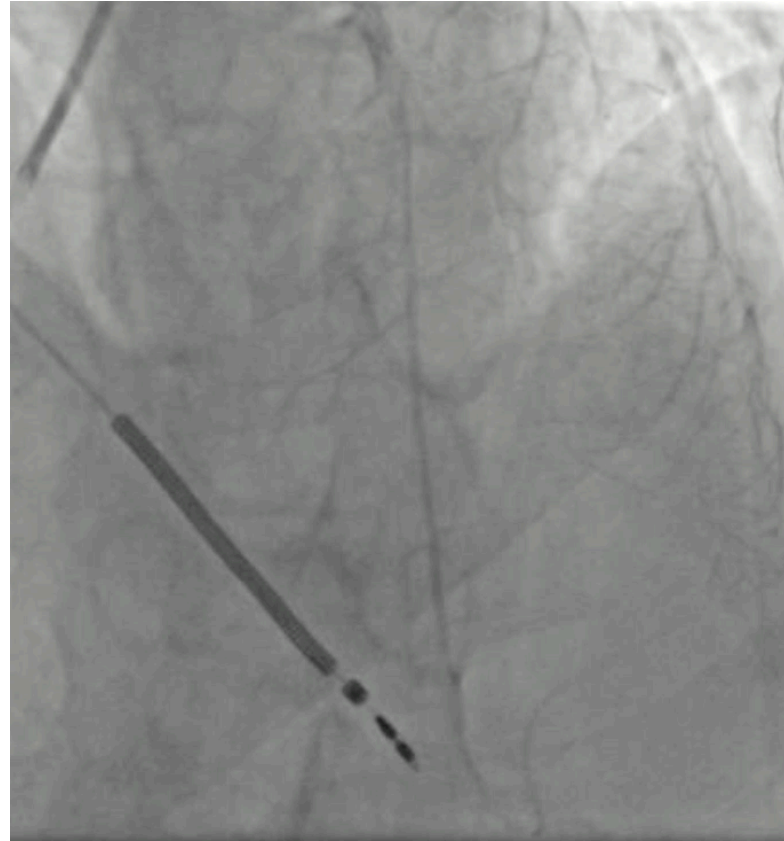
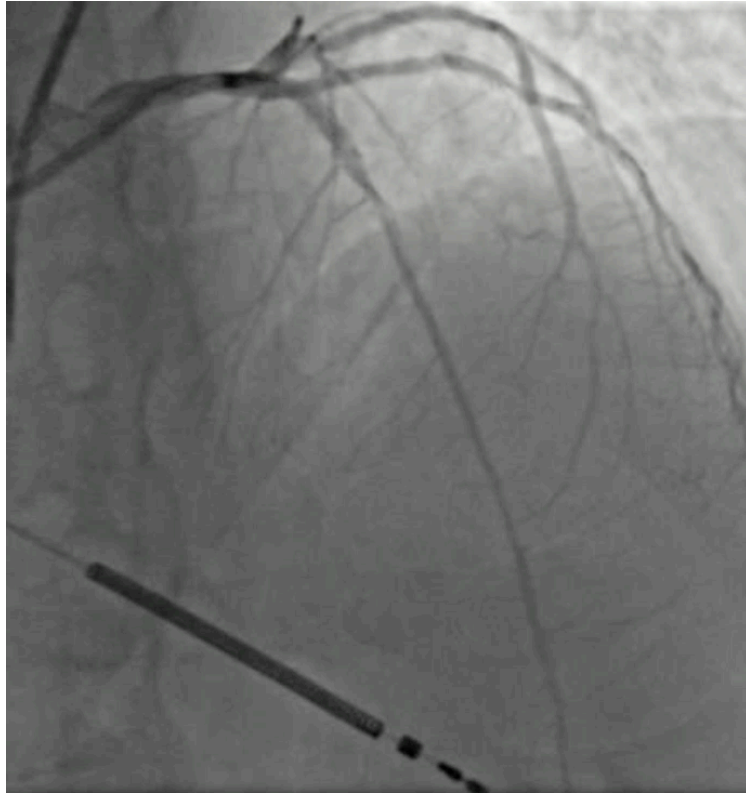
NC 2x20 and DEB 2x20



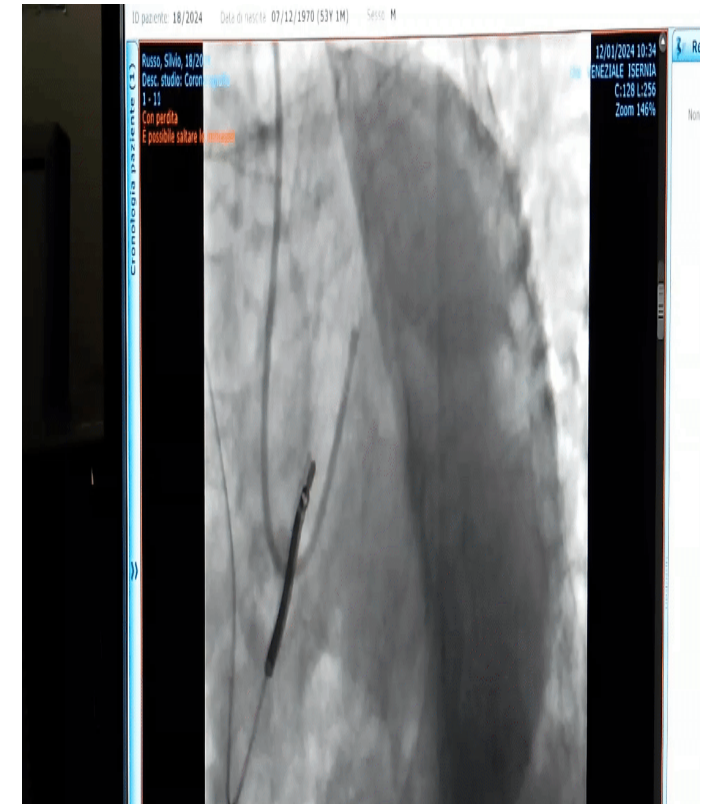
NC 2,5x20 and DEB 2,5x20



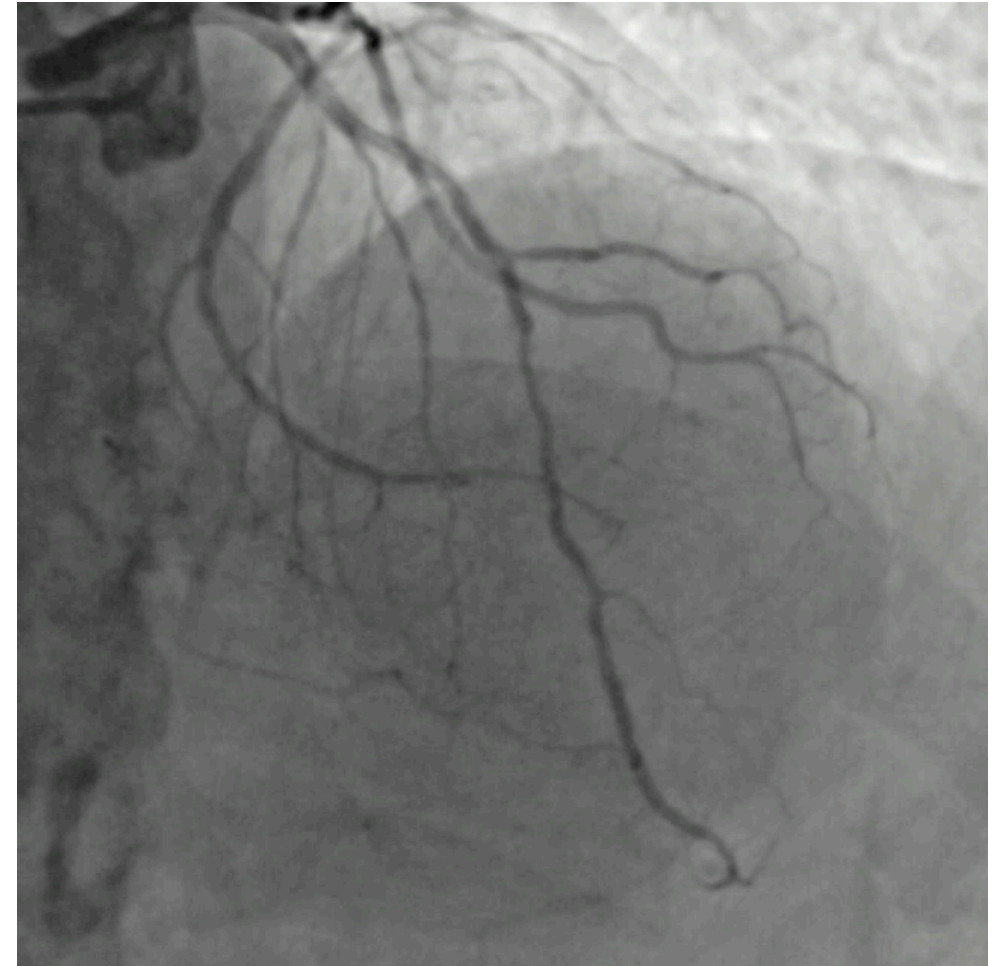
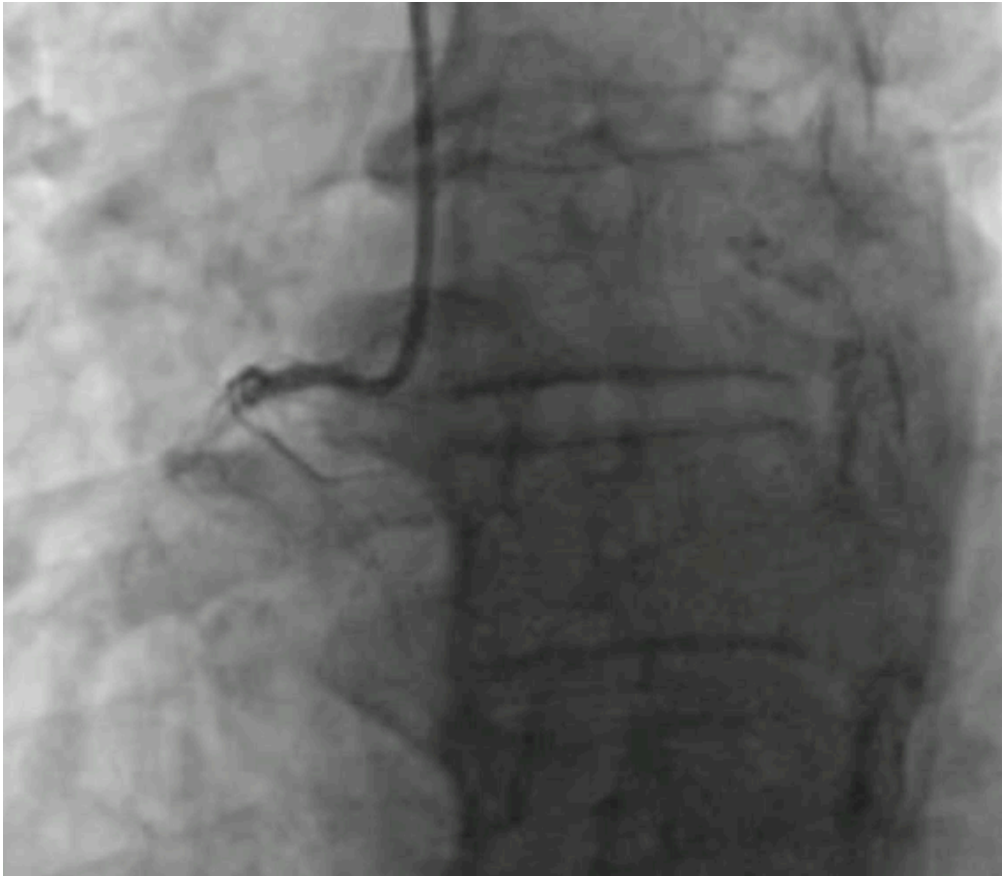
Result



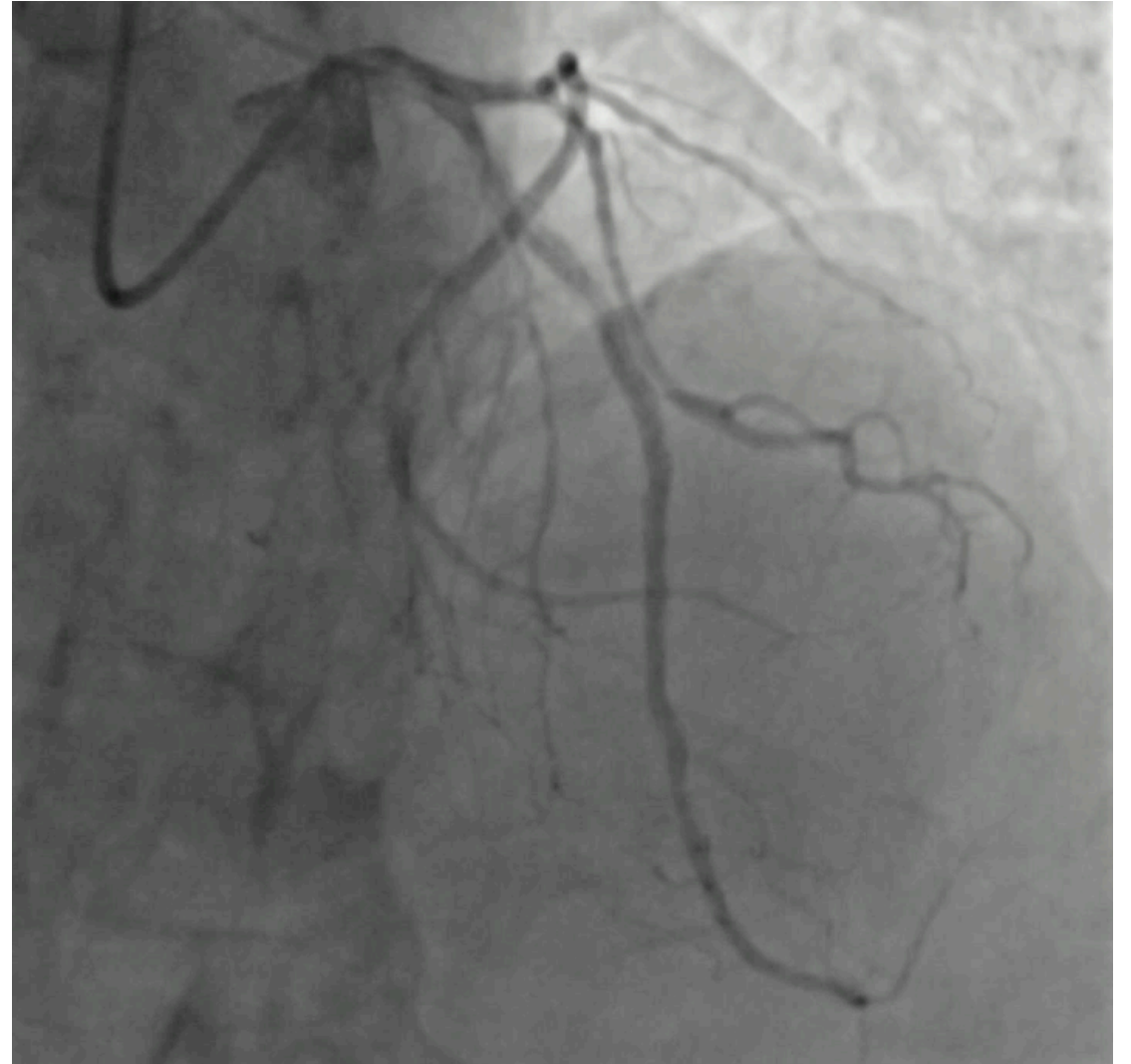
3 months follow up



75 y, Physician, angina, previous PCI on LAD and RCA
Previous failure of RCA CTO



LAD PCI



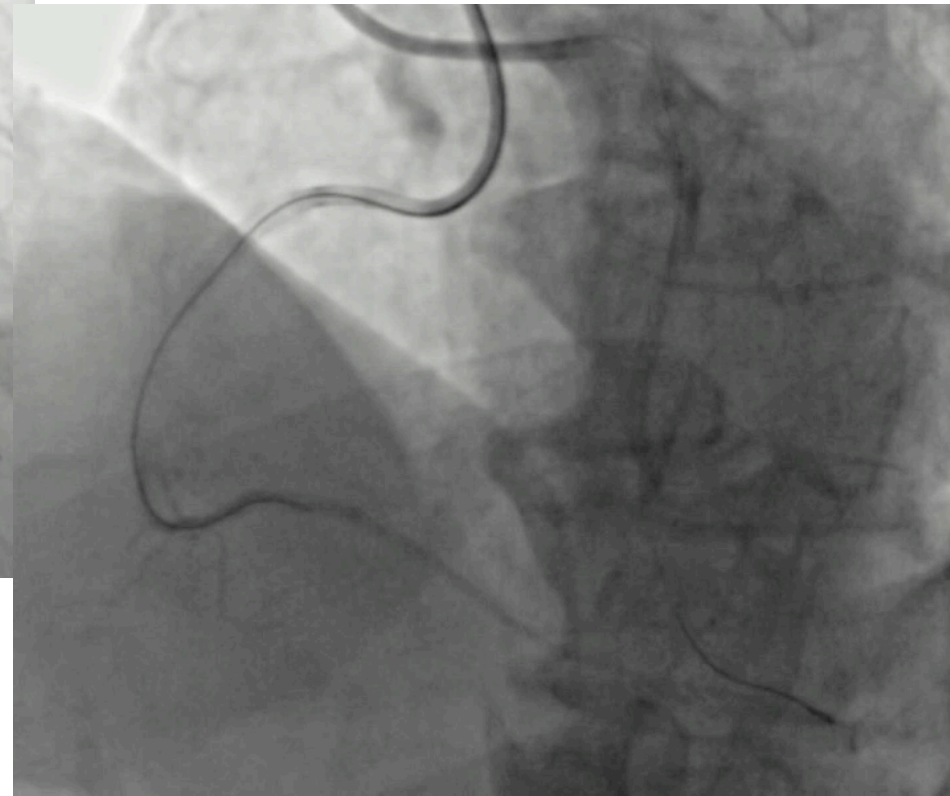
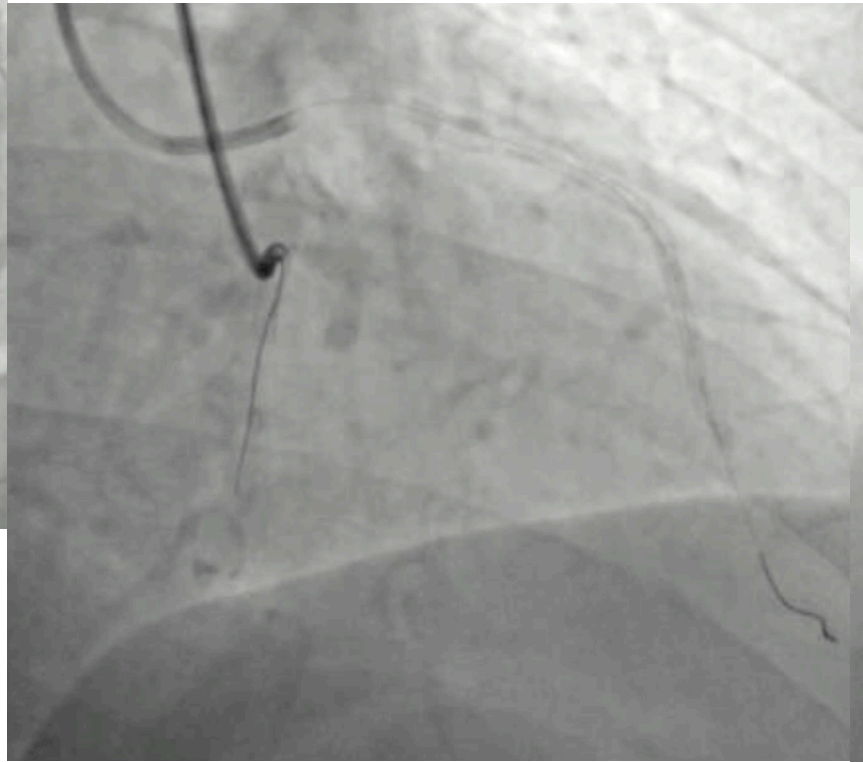
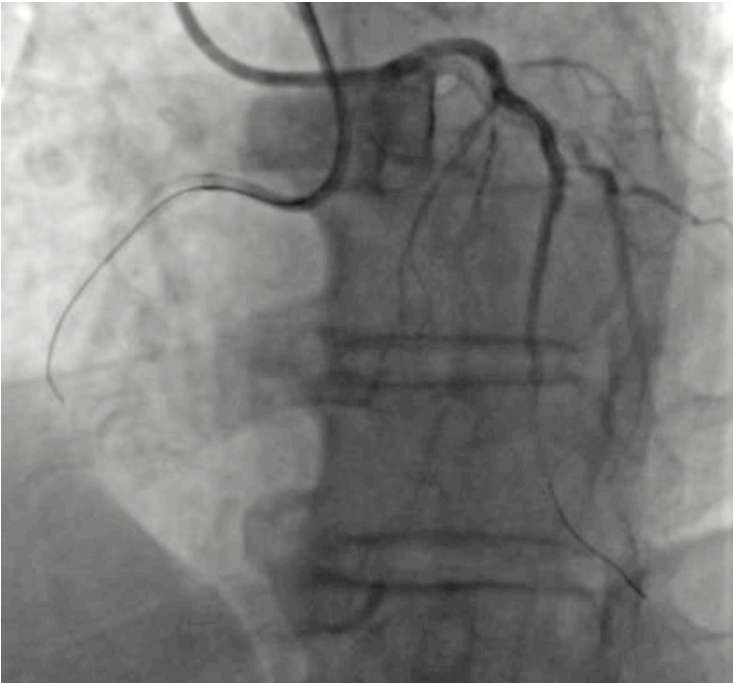
Still symptomatic

- Referred for CTO PCI



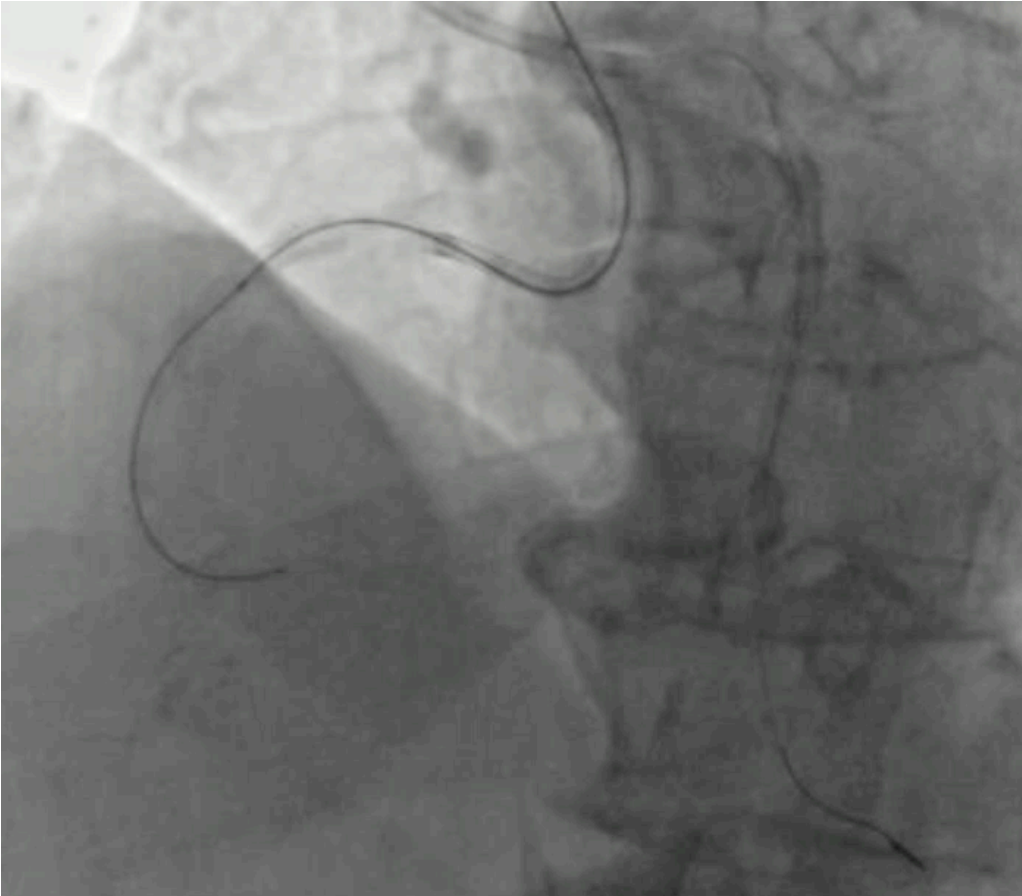
calcium, lenght,
ambuous cap,
previous attempt
JCTO 4:

Subintimal tracking and reentry

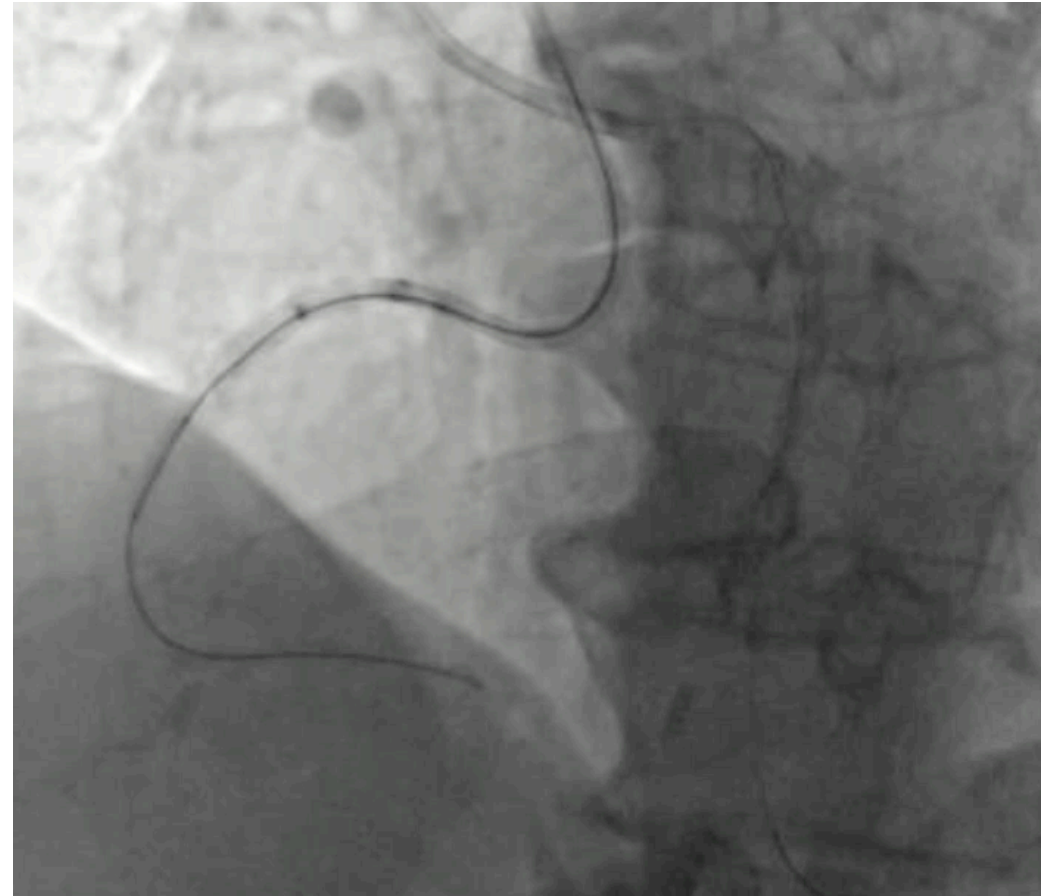


Uncrossable lesion

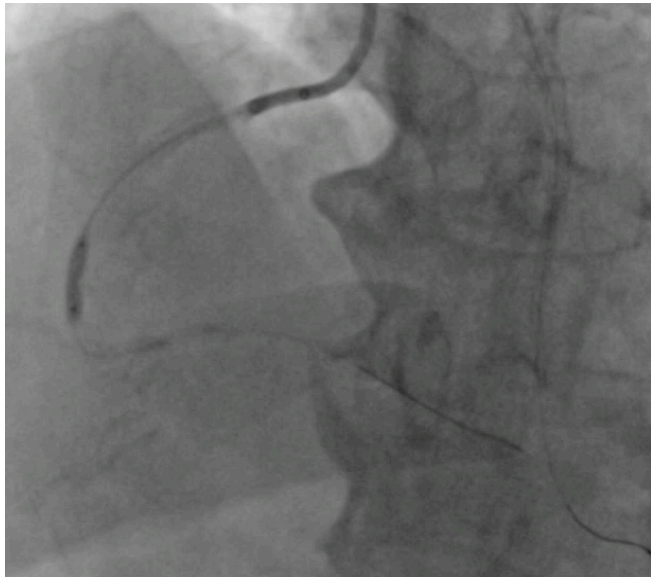
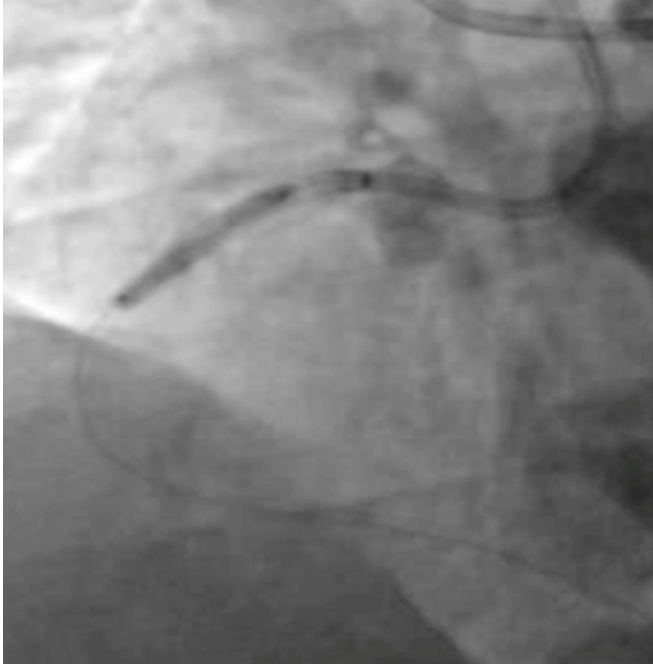
Granadoplasty



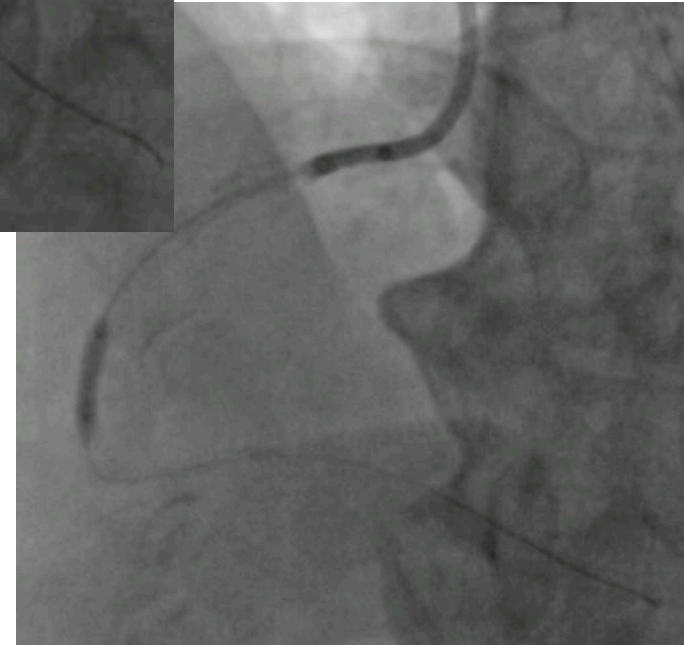
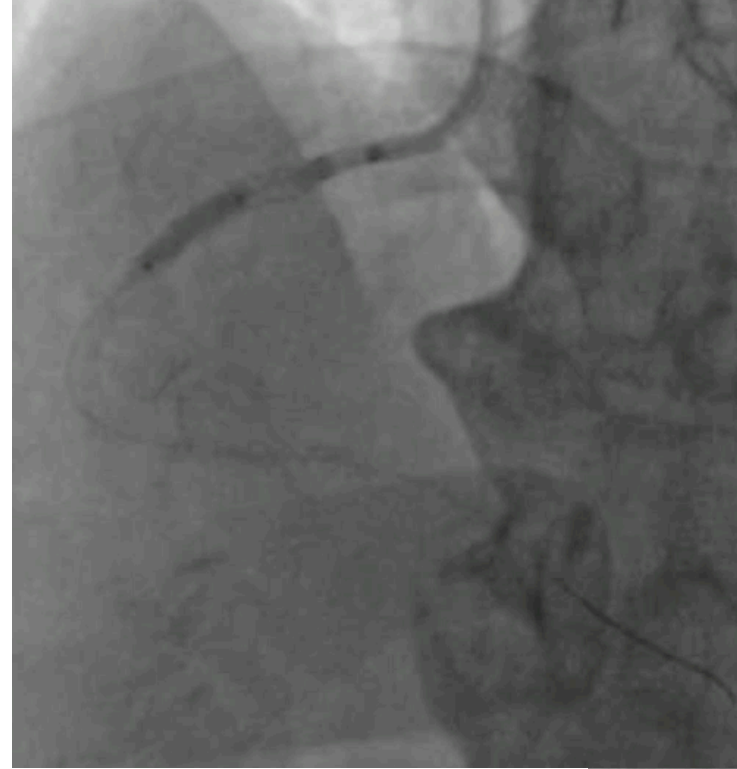
Child in mother



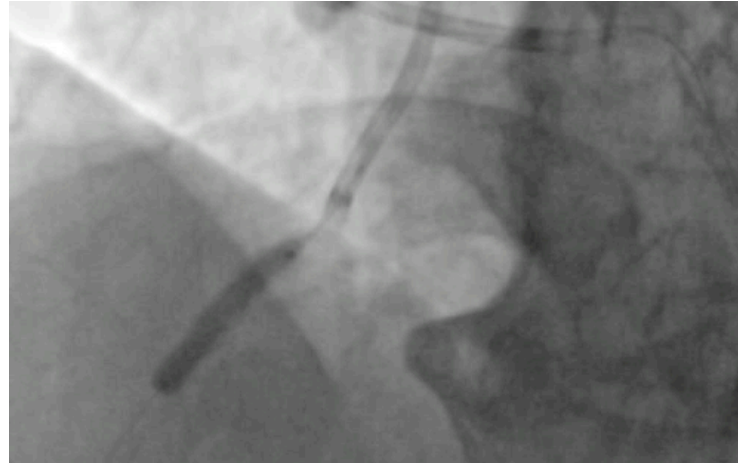
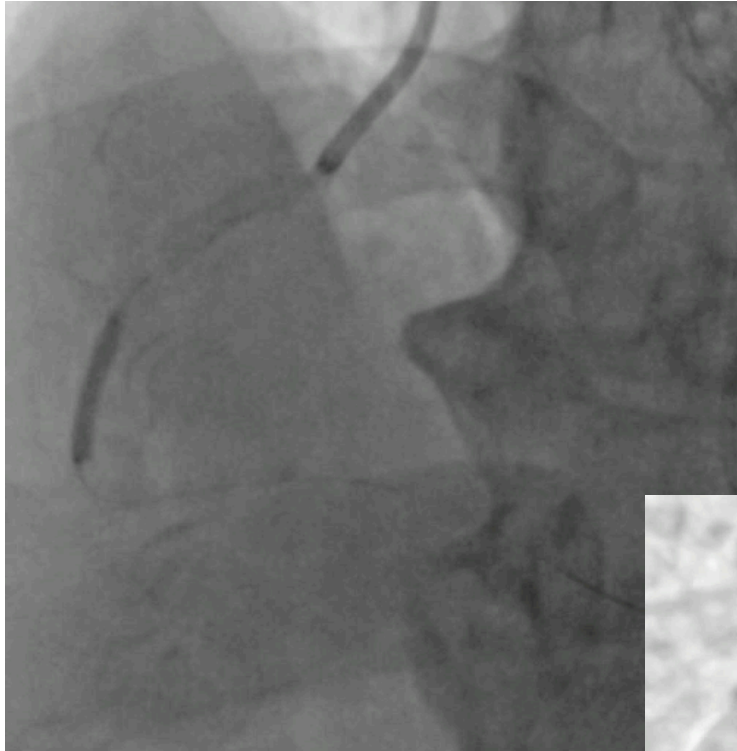
Undilatable lesions



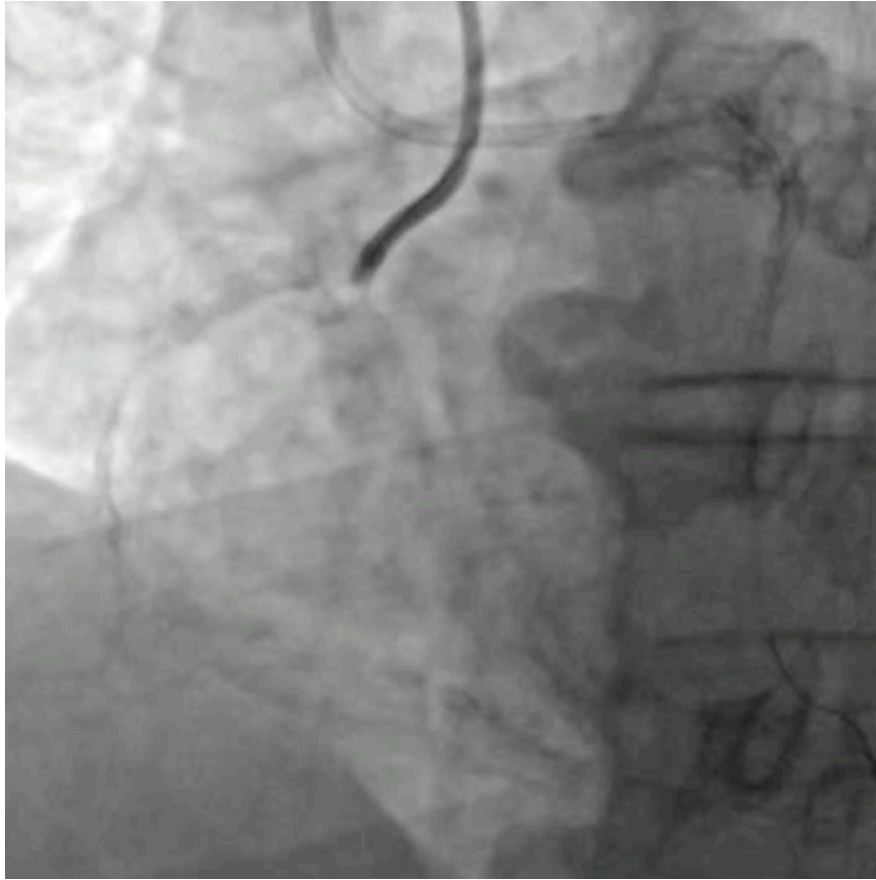
Shockwave 3,5



DCB only



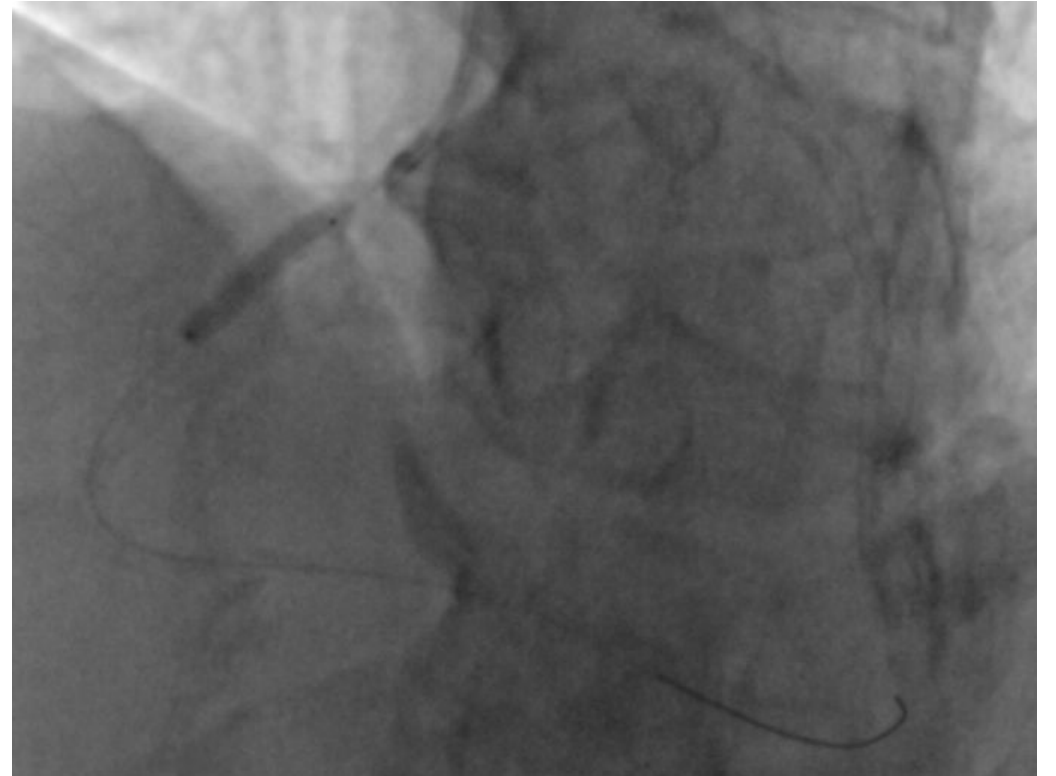
Suboptimal result



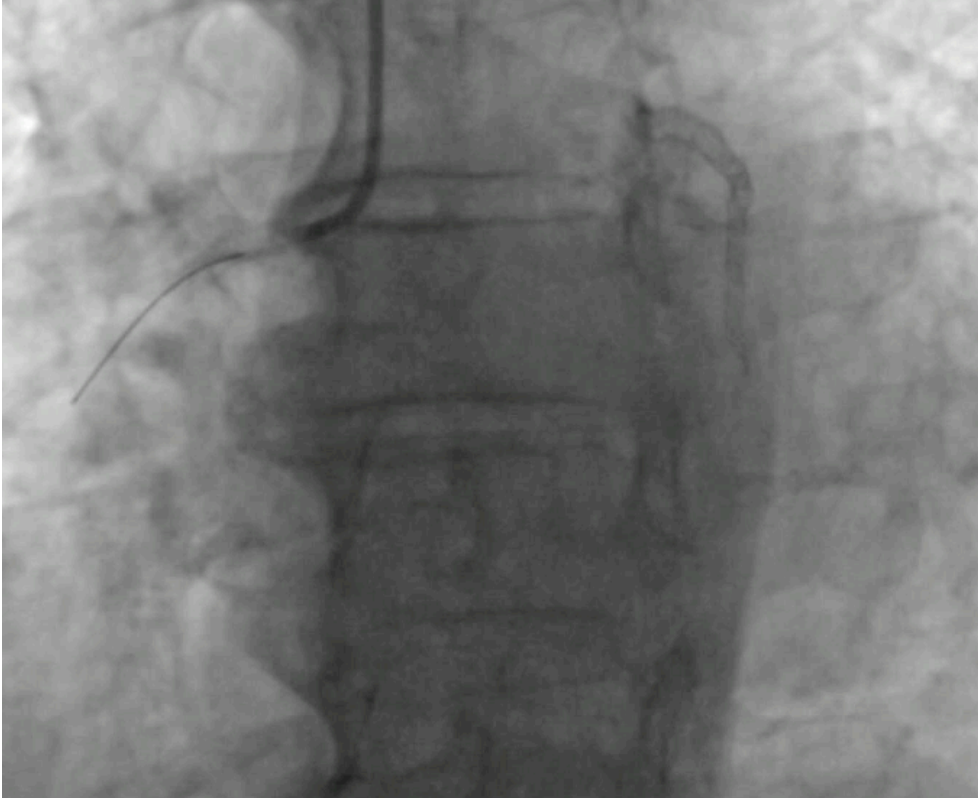
3 months follow up



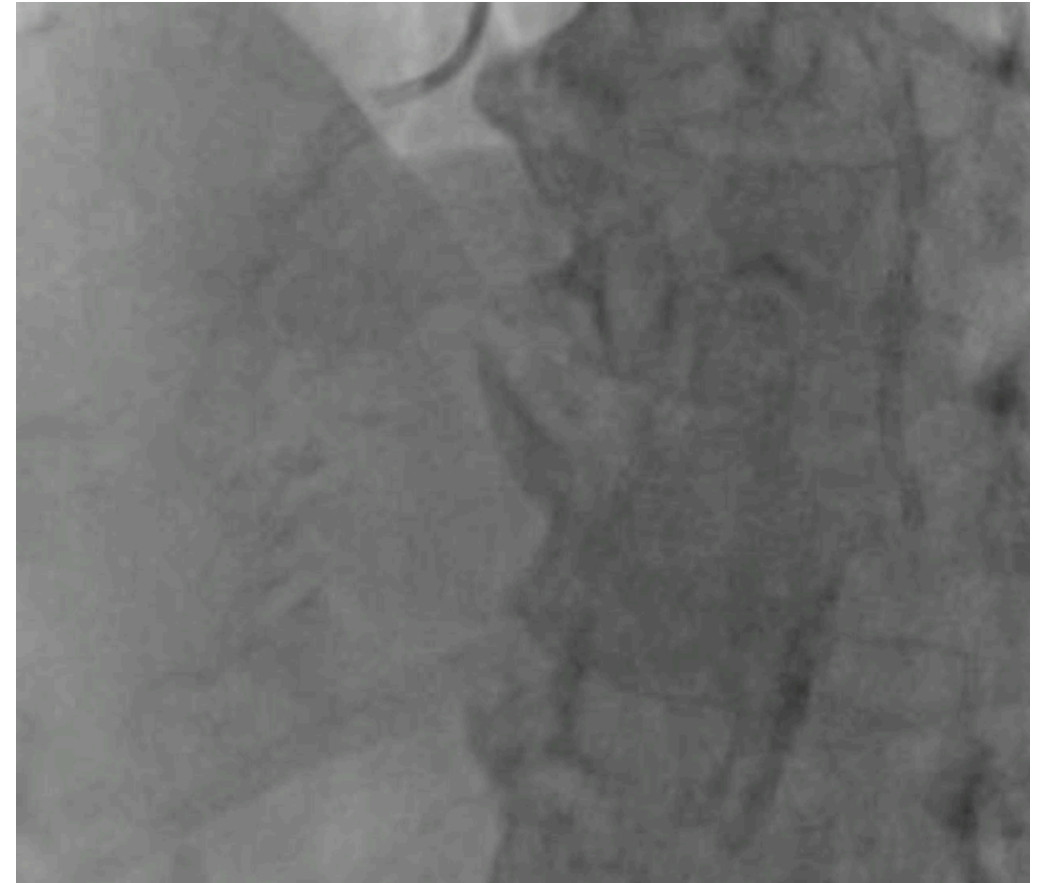
Redo DCB



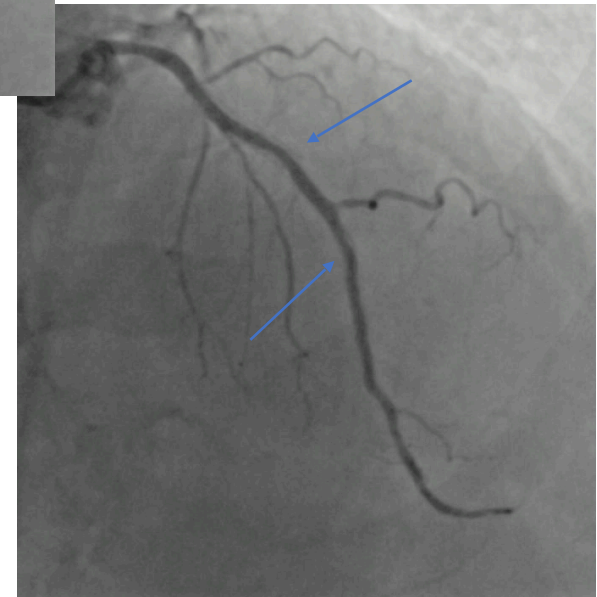
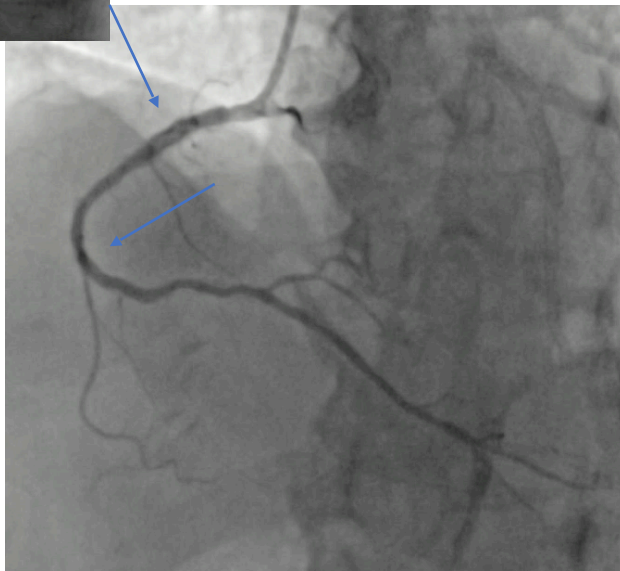
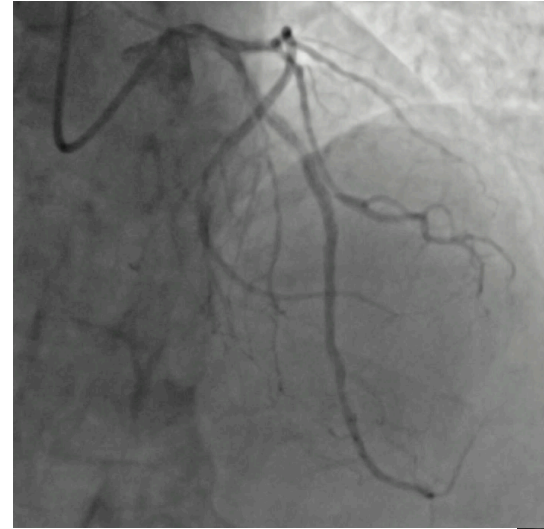
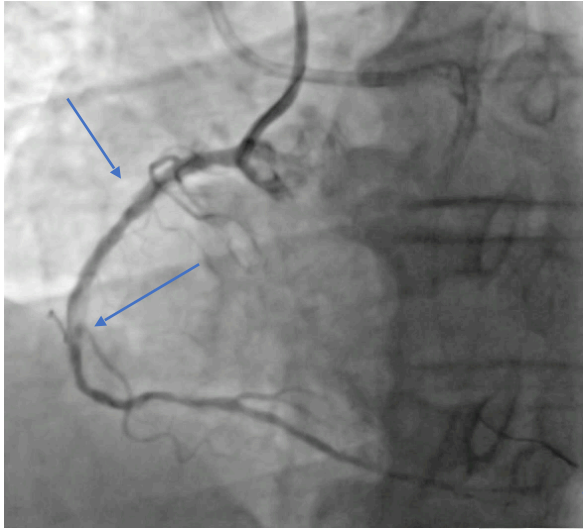
Redo result



9 months follow up

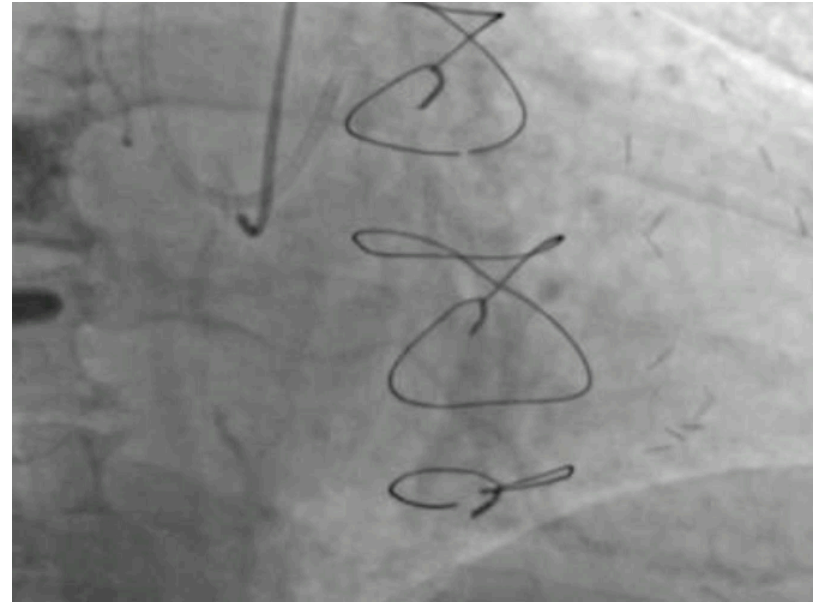
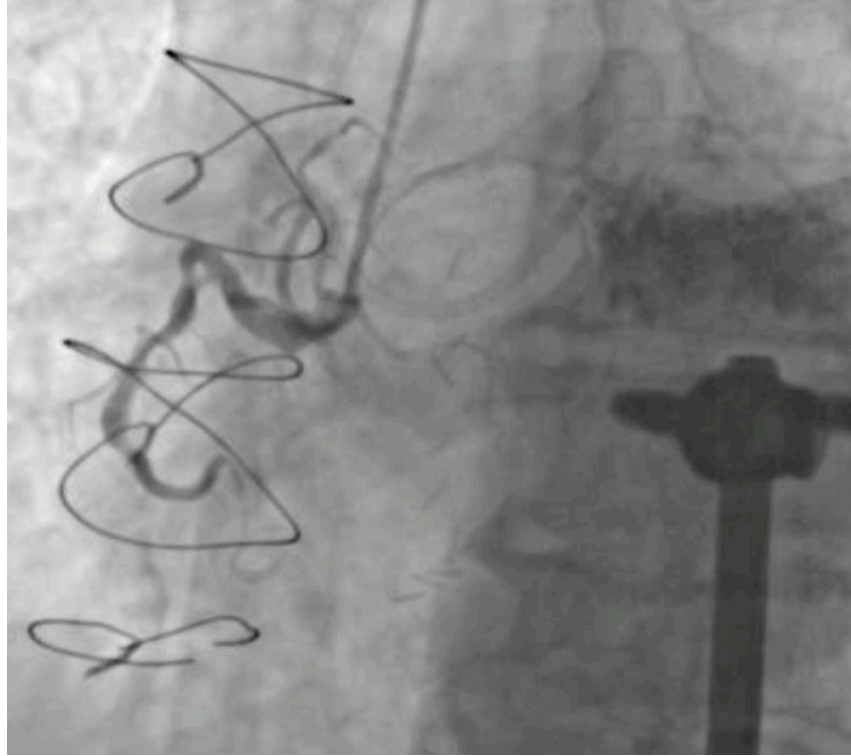
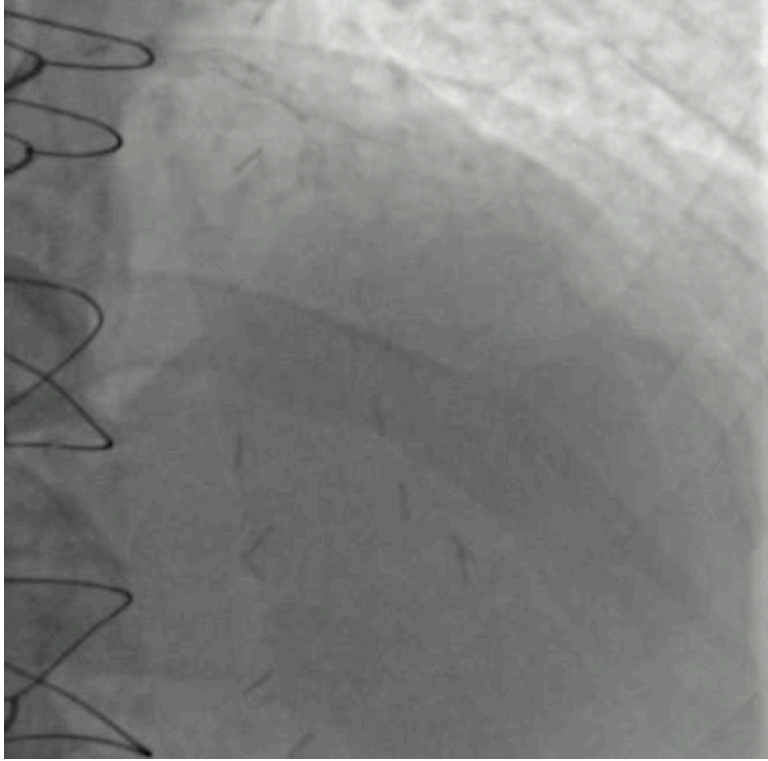


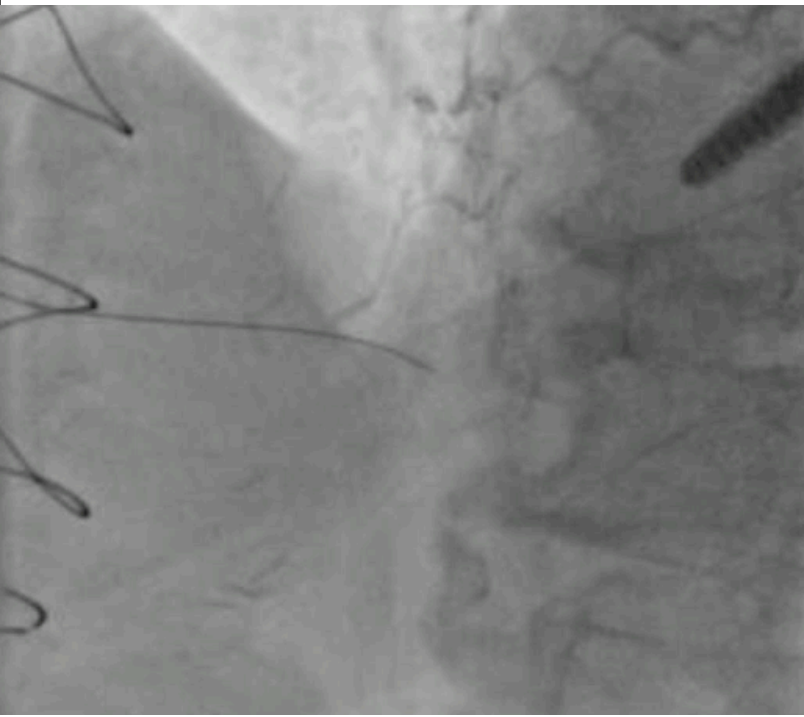
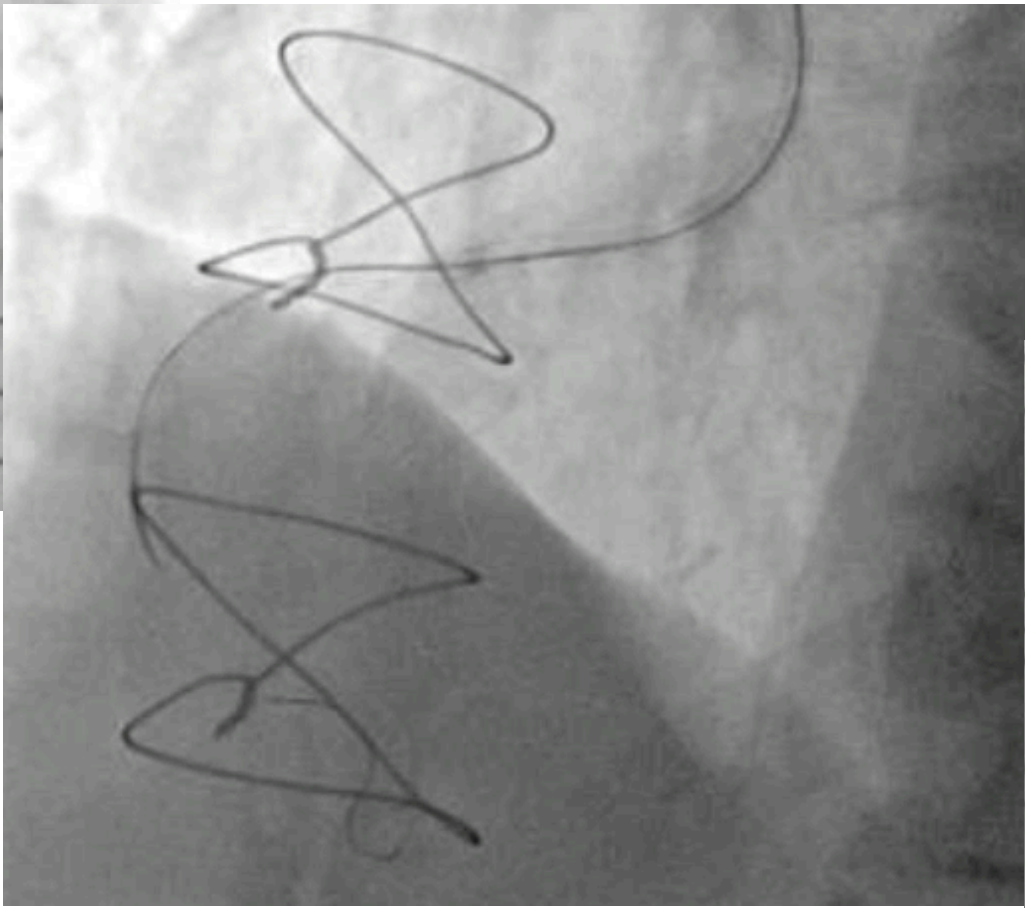
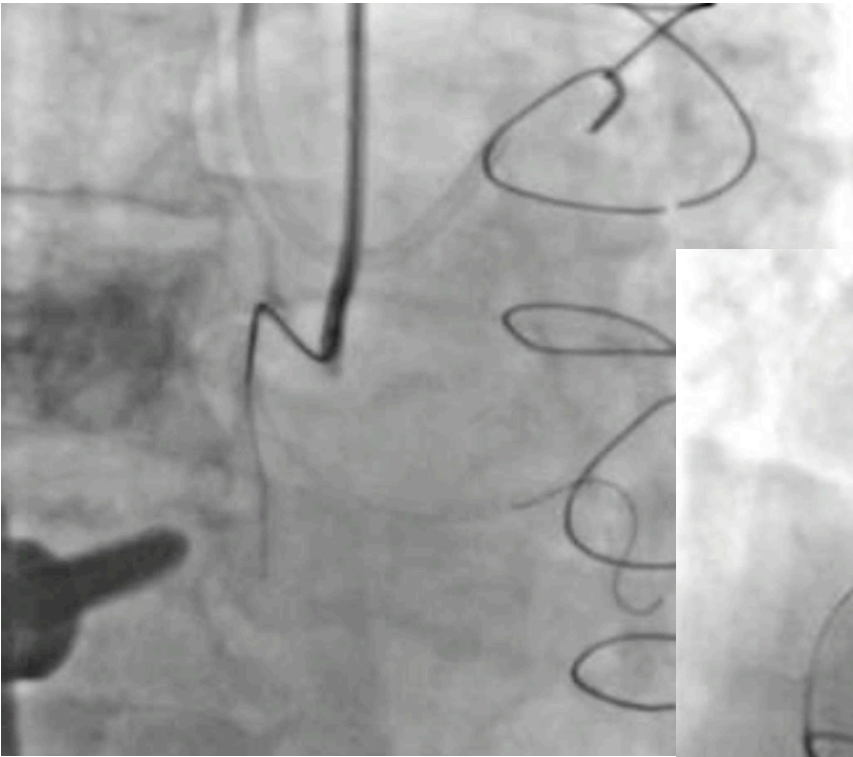
At 9 months follow up: stent worsening and DCB territory improvement

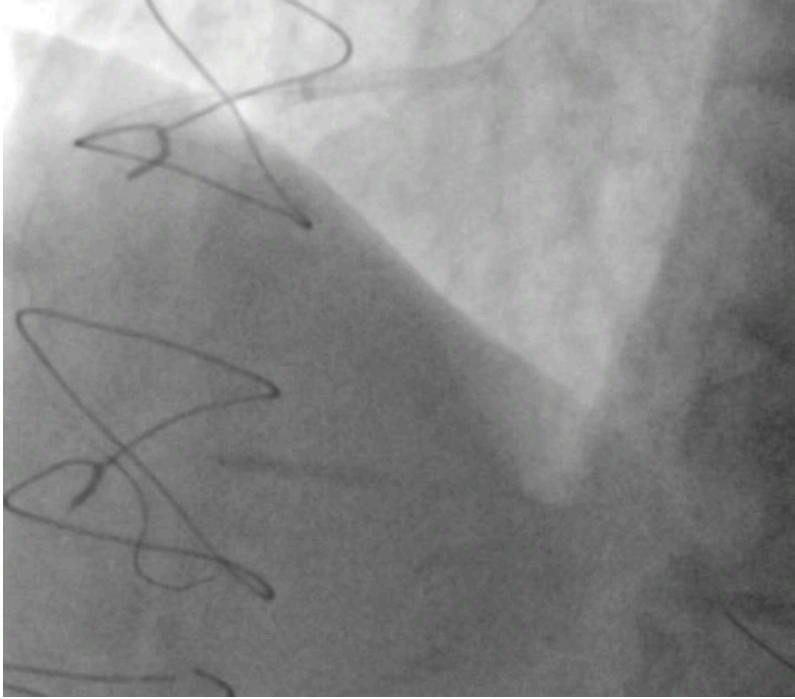


CASE 2

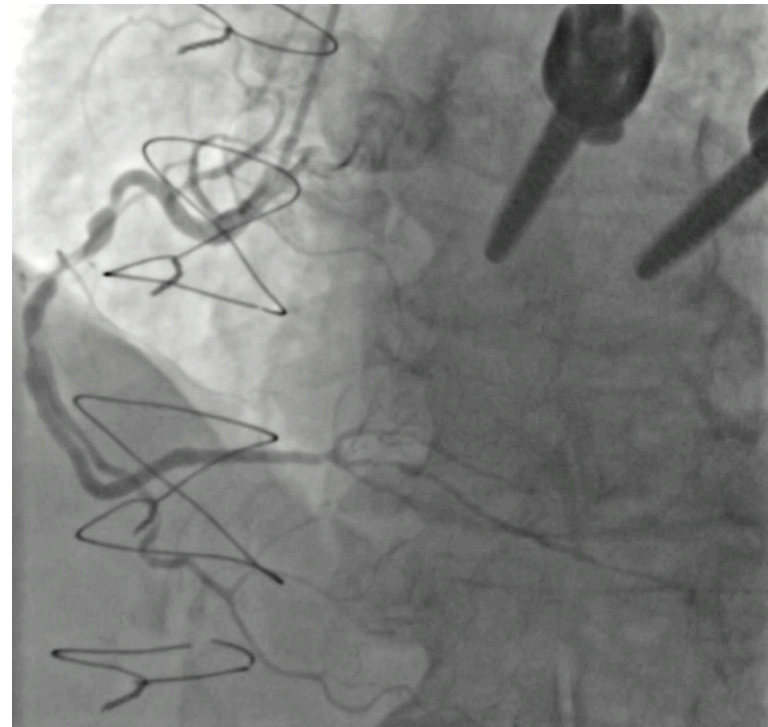
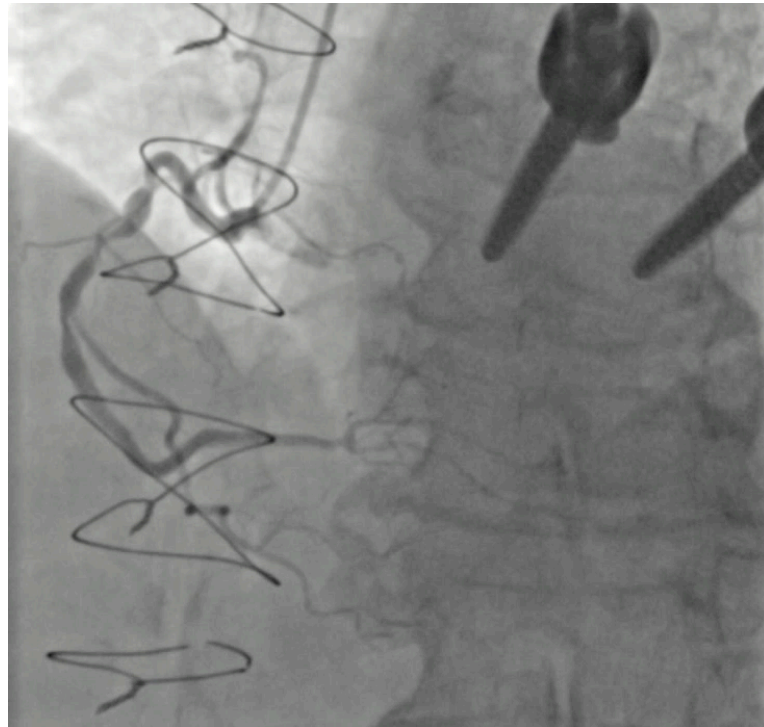
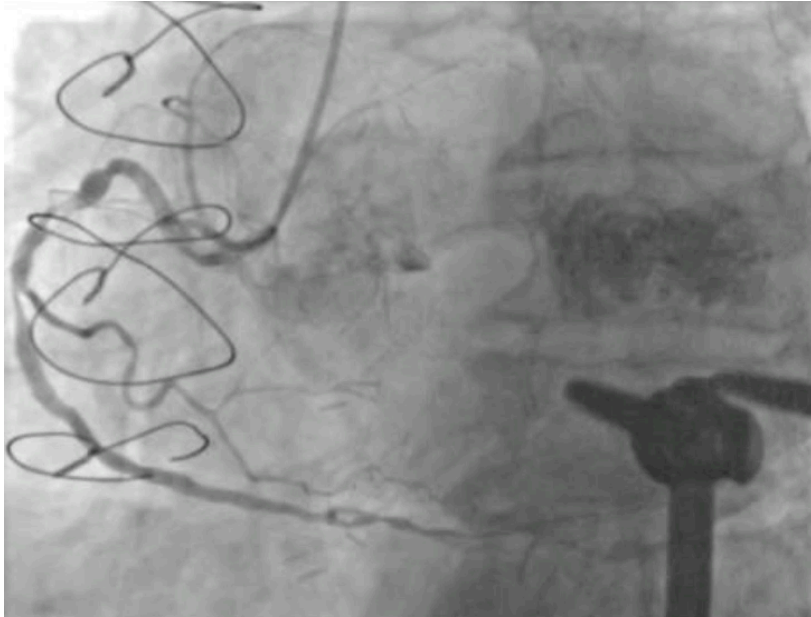
73 y, angina, cabg; RCA SVG occlusion with RCA-CTO



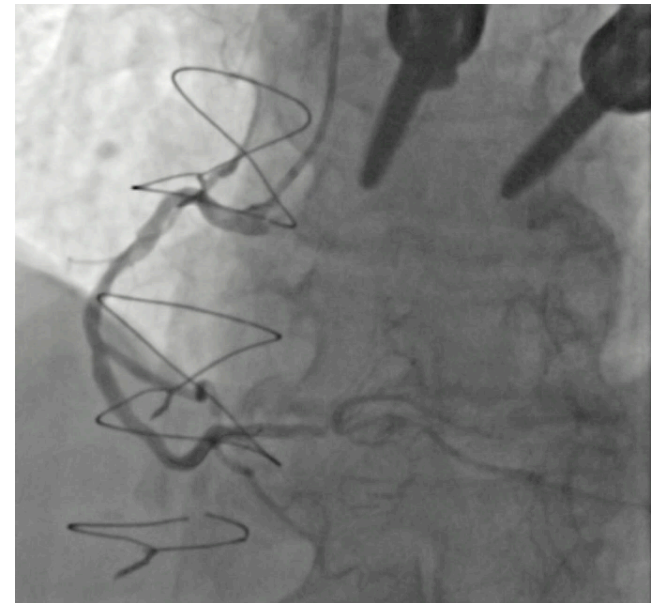
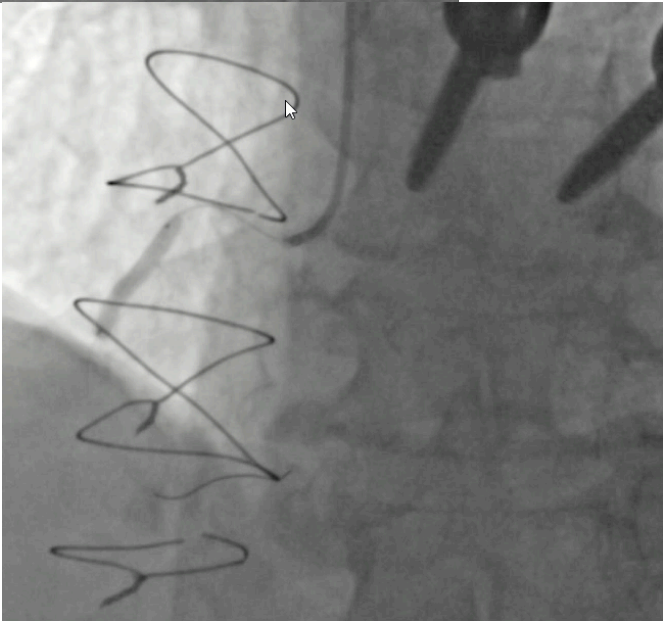
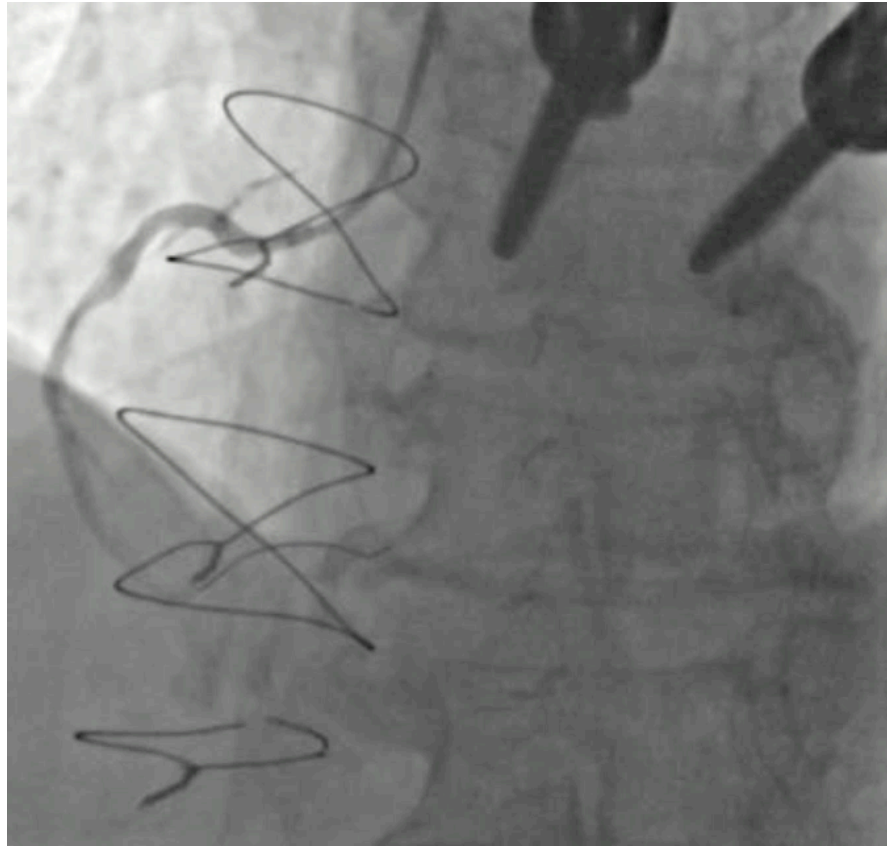
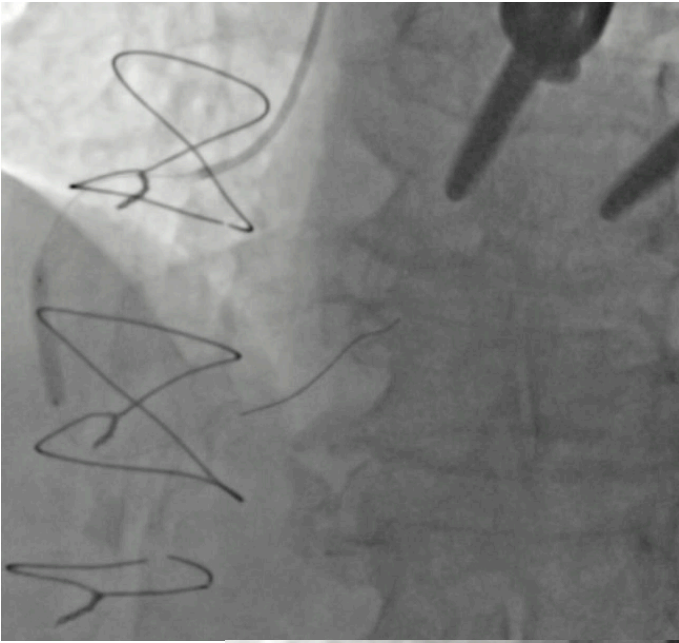




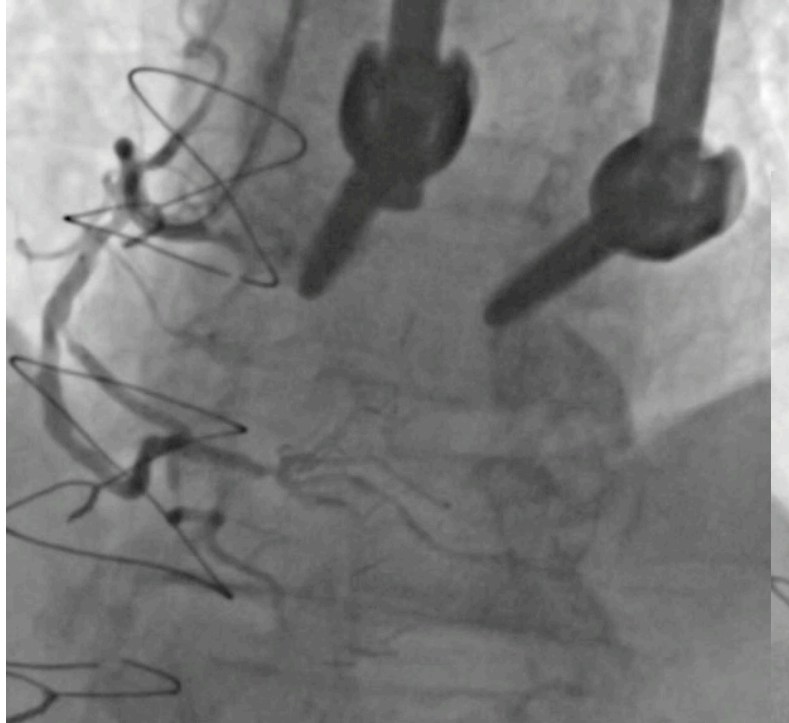
Result after 9 mounts



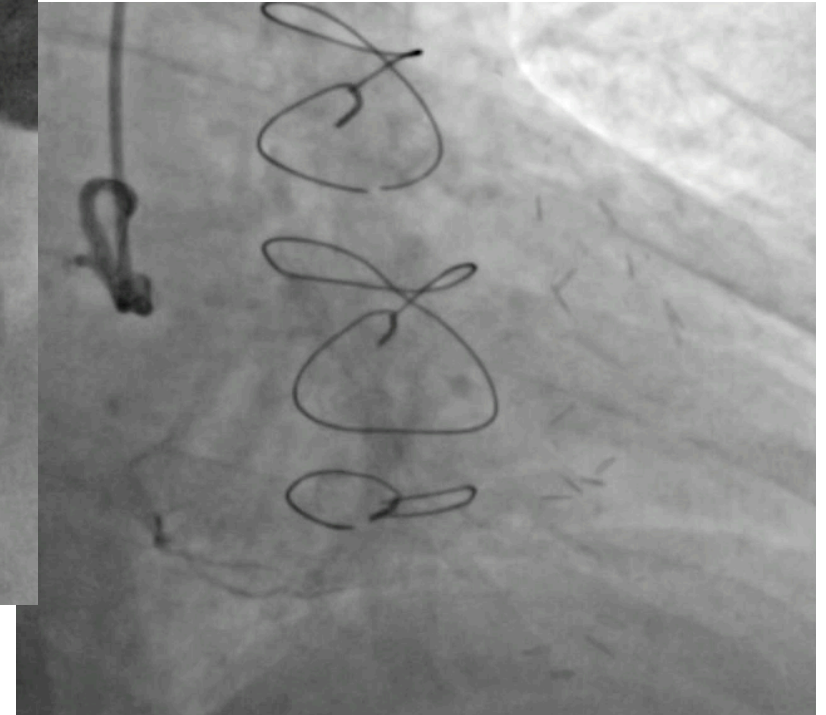
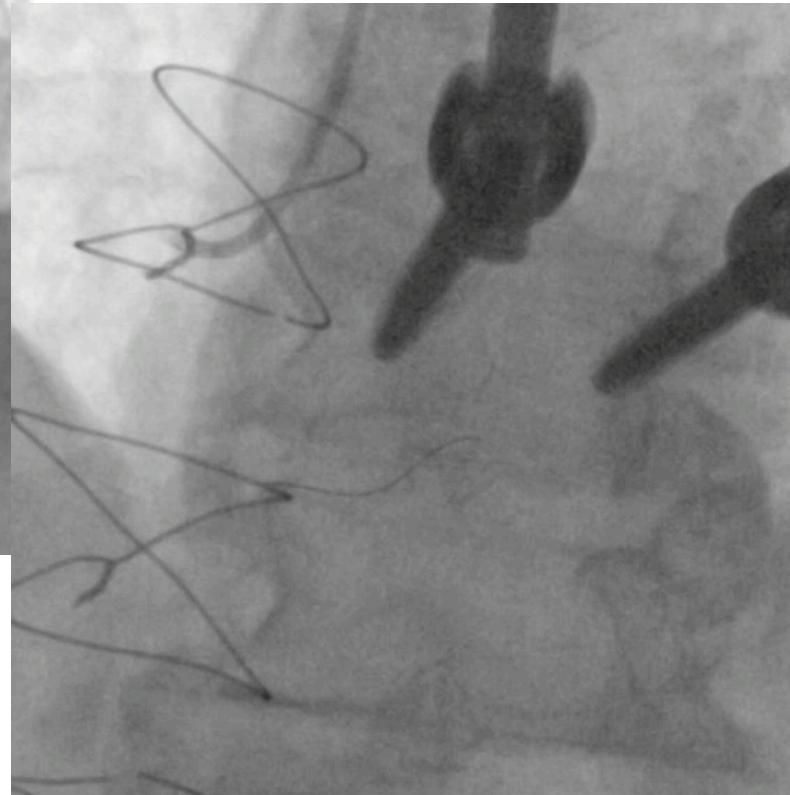
Redoo DCB mid and proximal



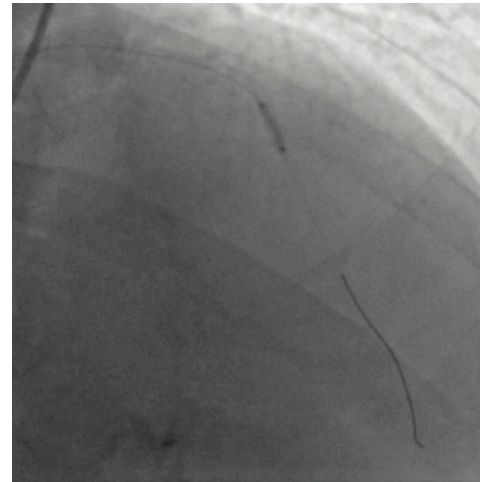
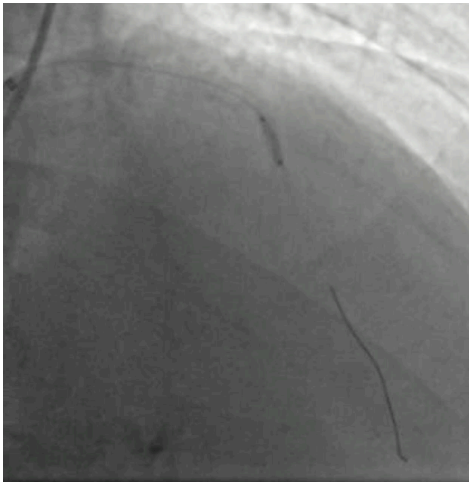
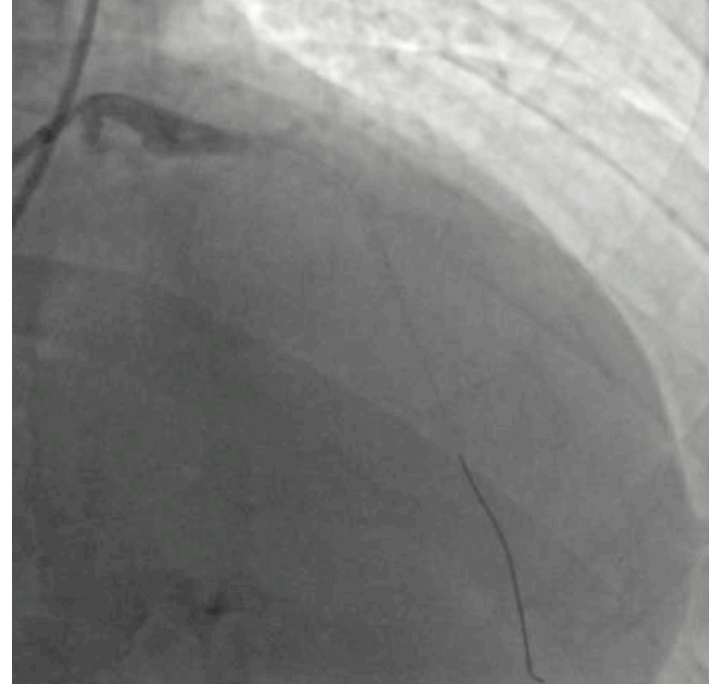
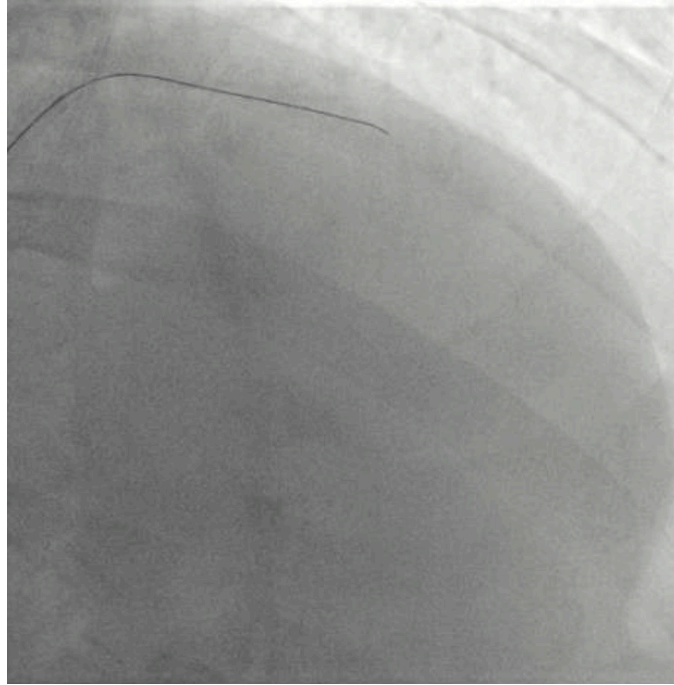
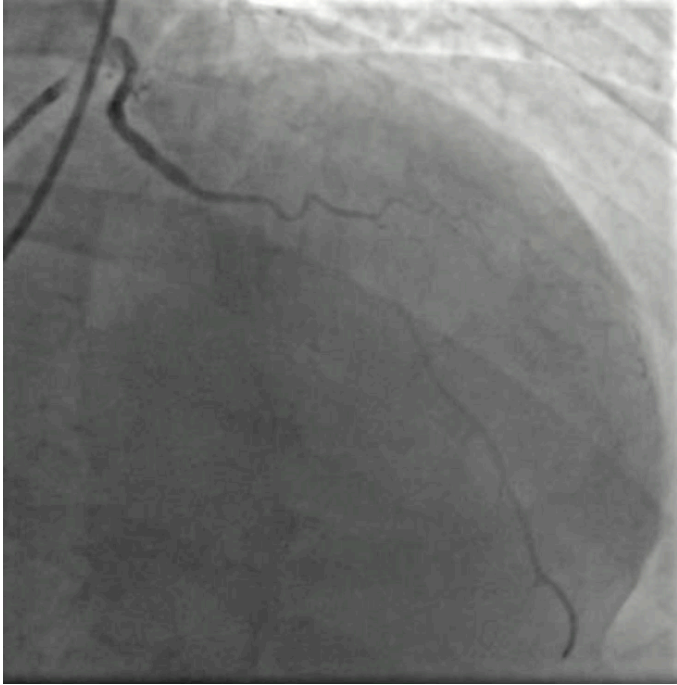
9 months later with FFR

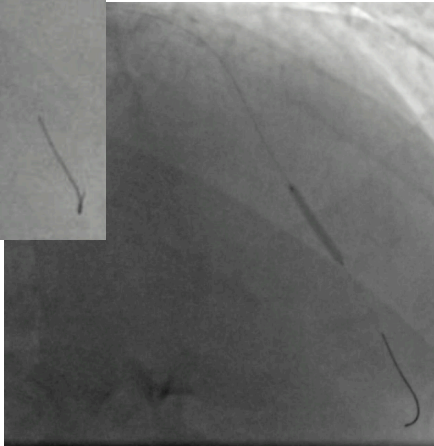
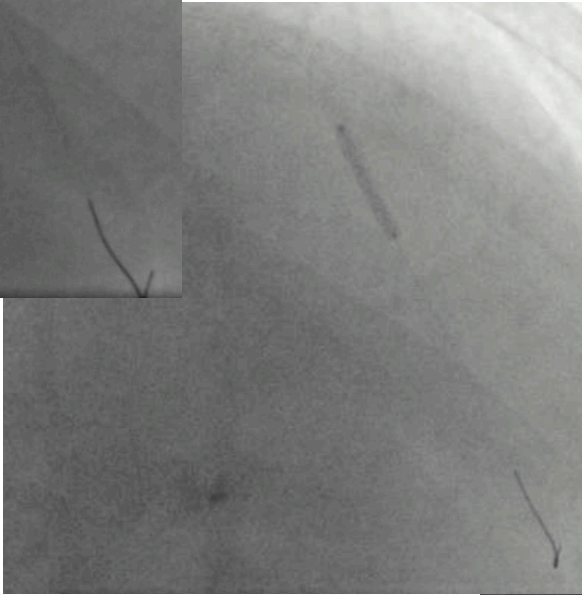
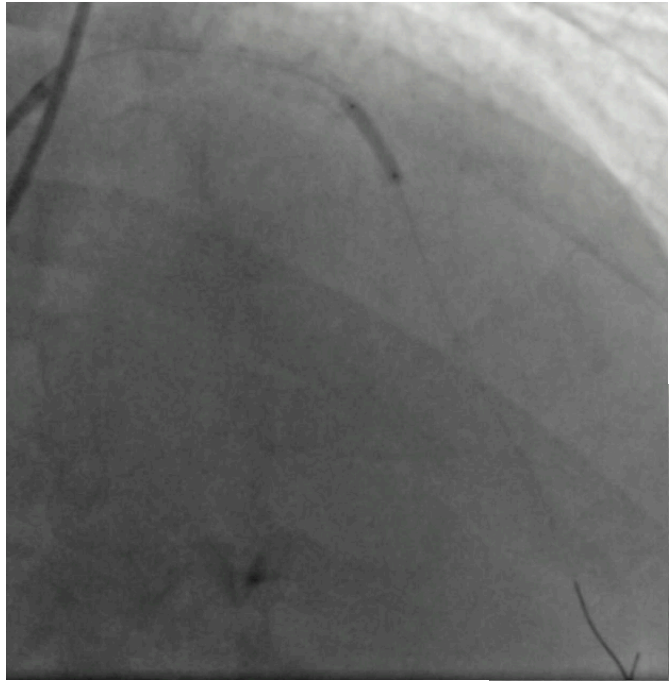


ffr in PL 0,9



48 y man

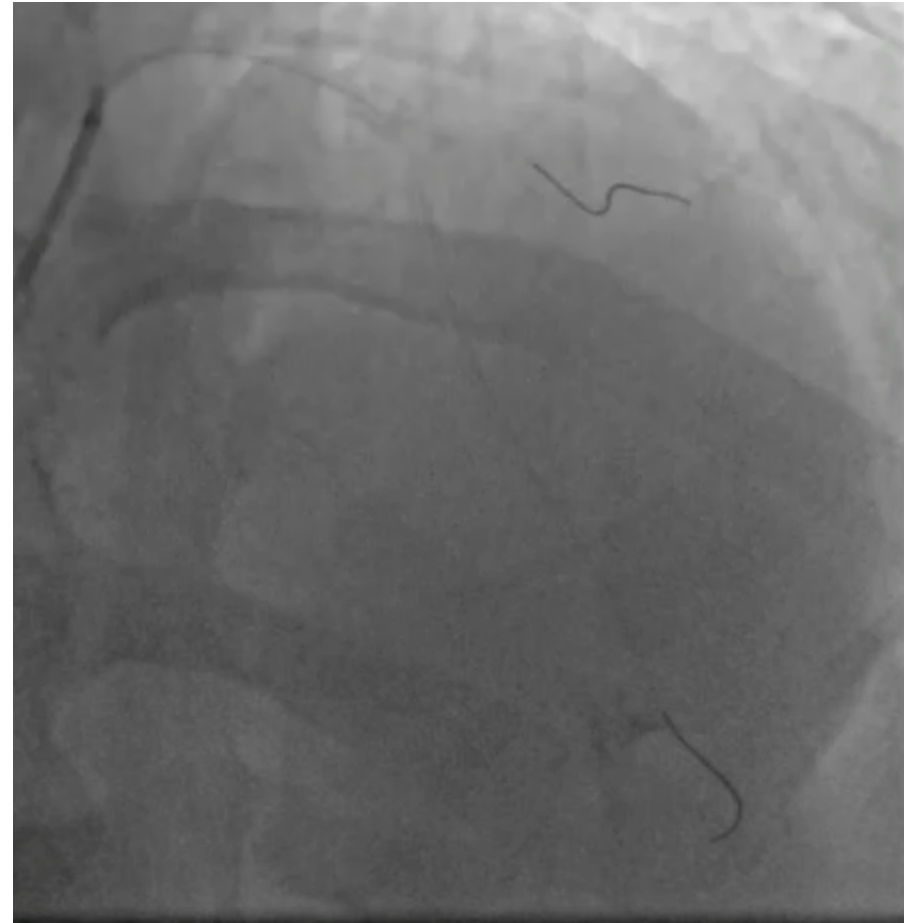
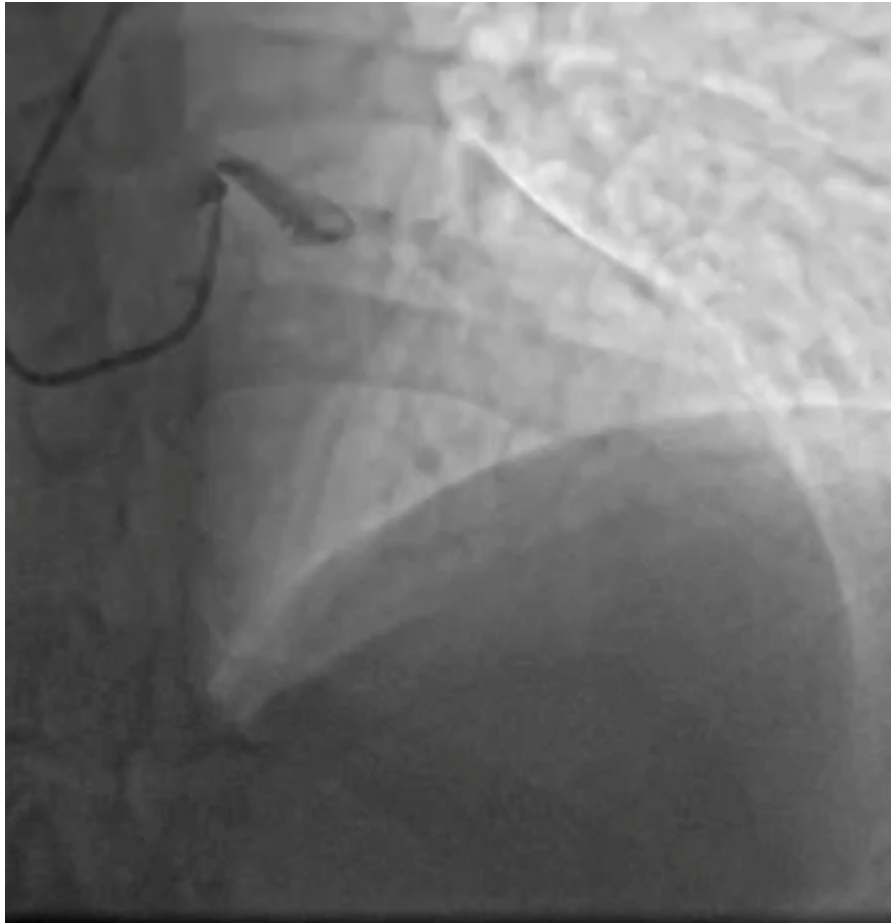


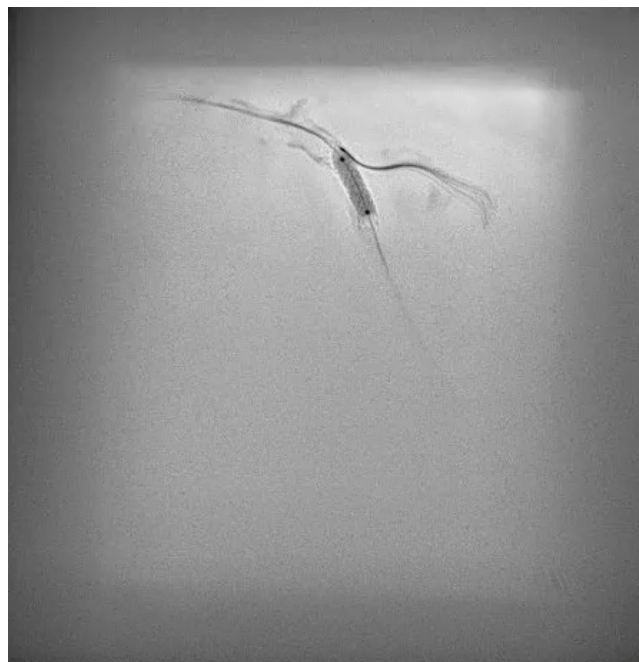
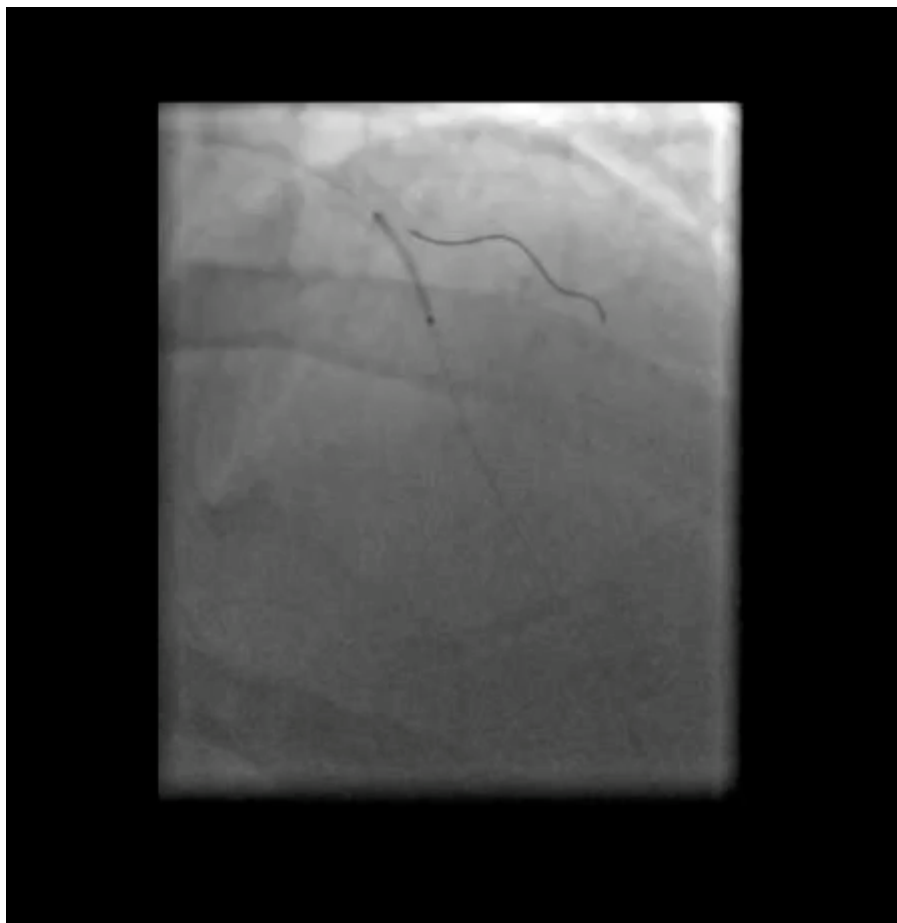


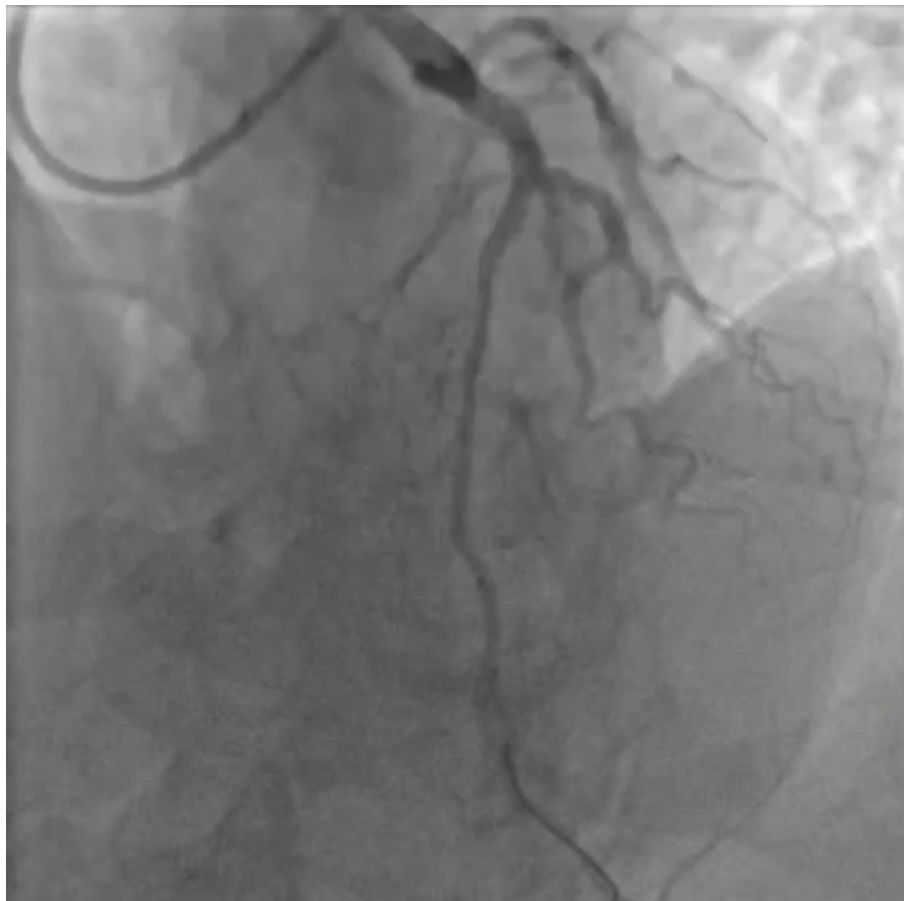
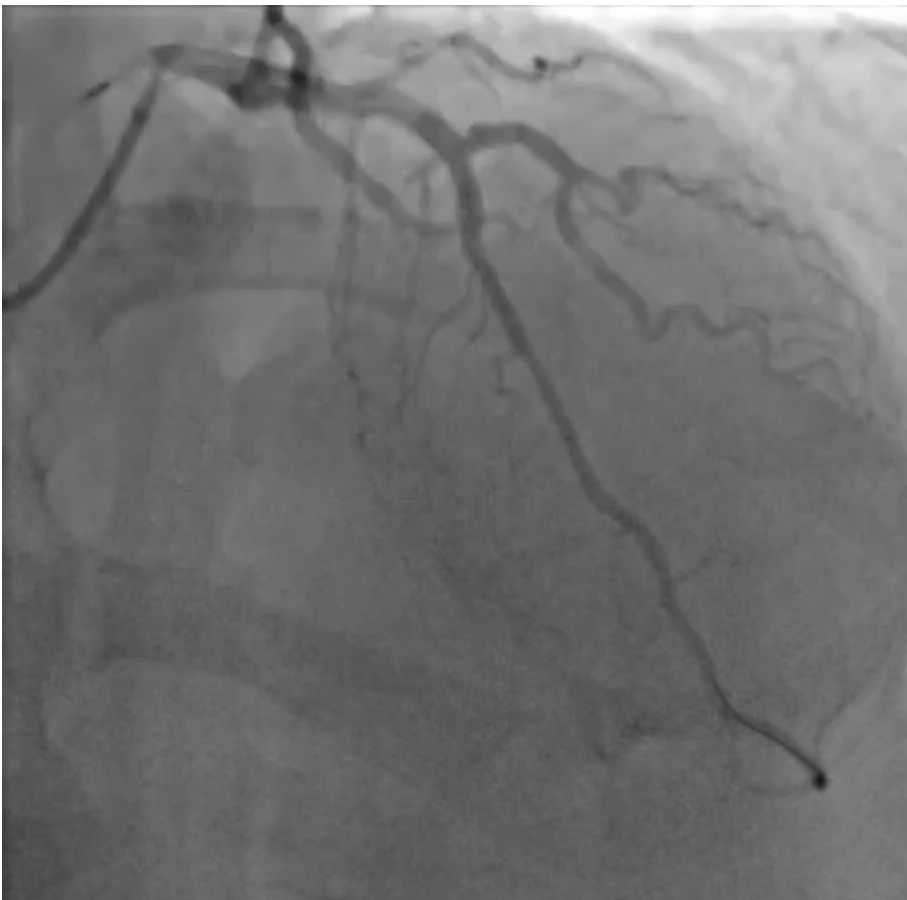
3 months redo dcb



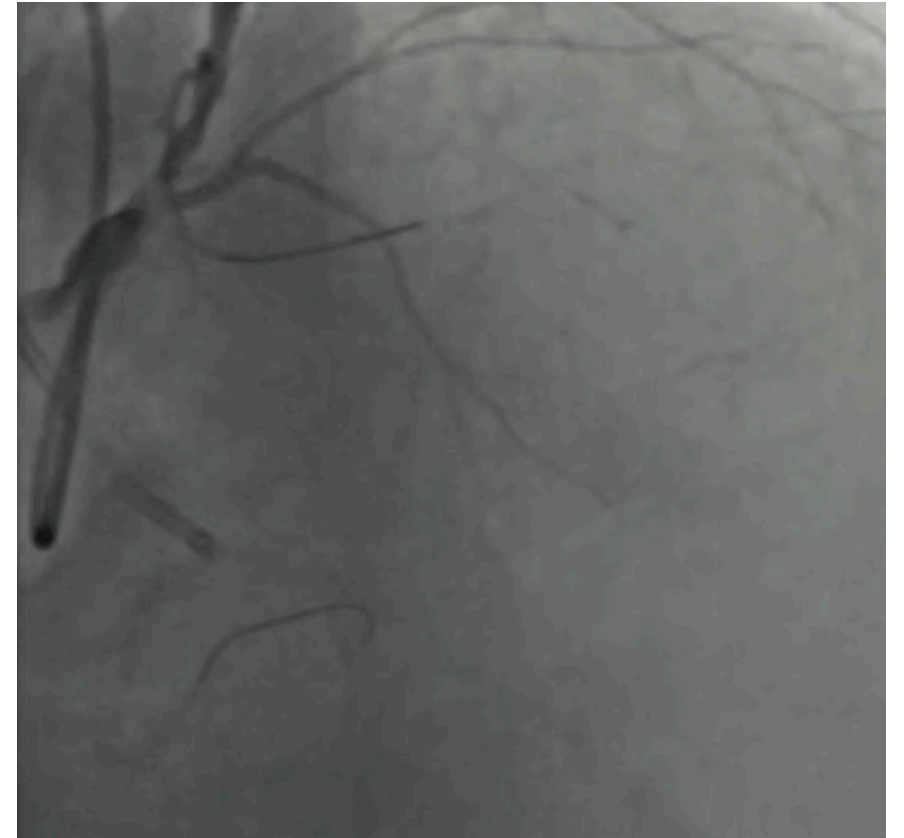
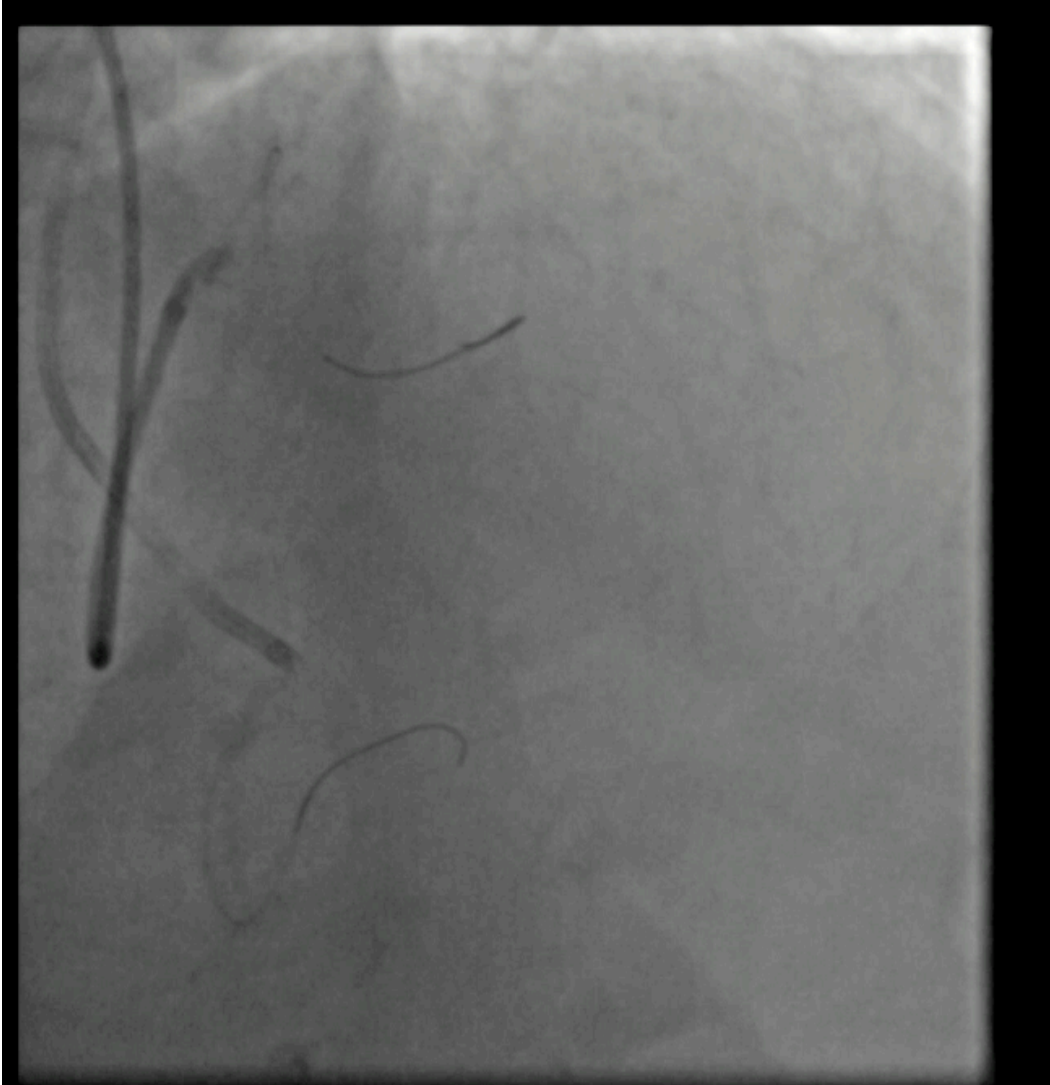
9 months

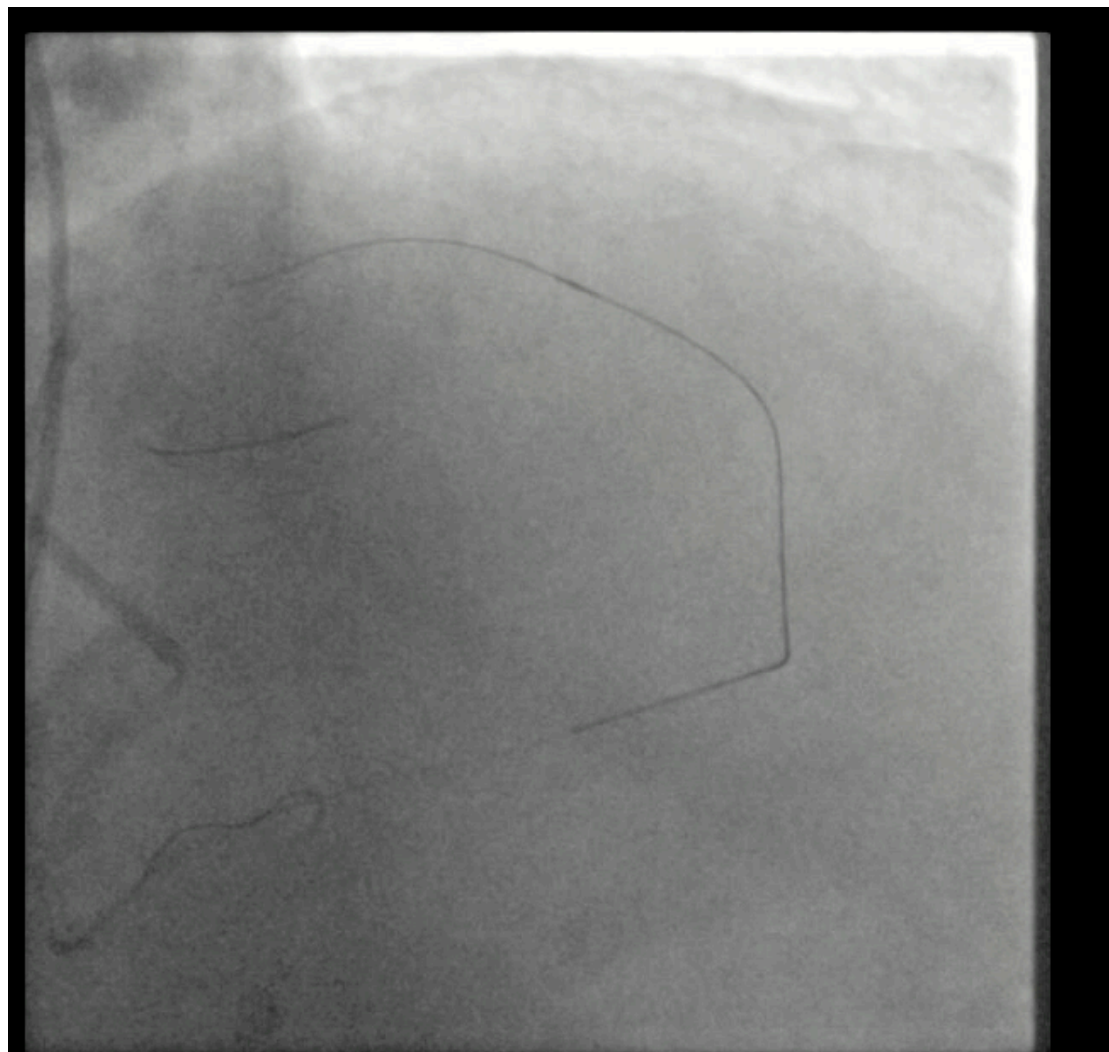
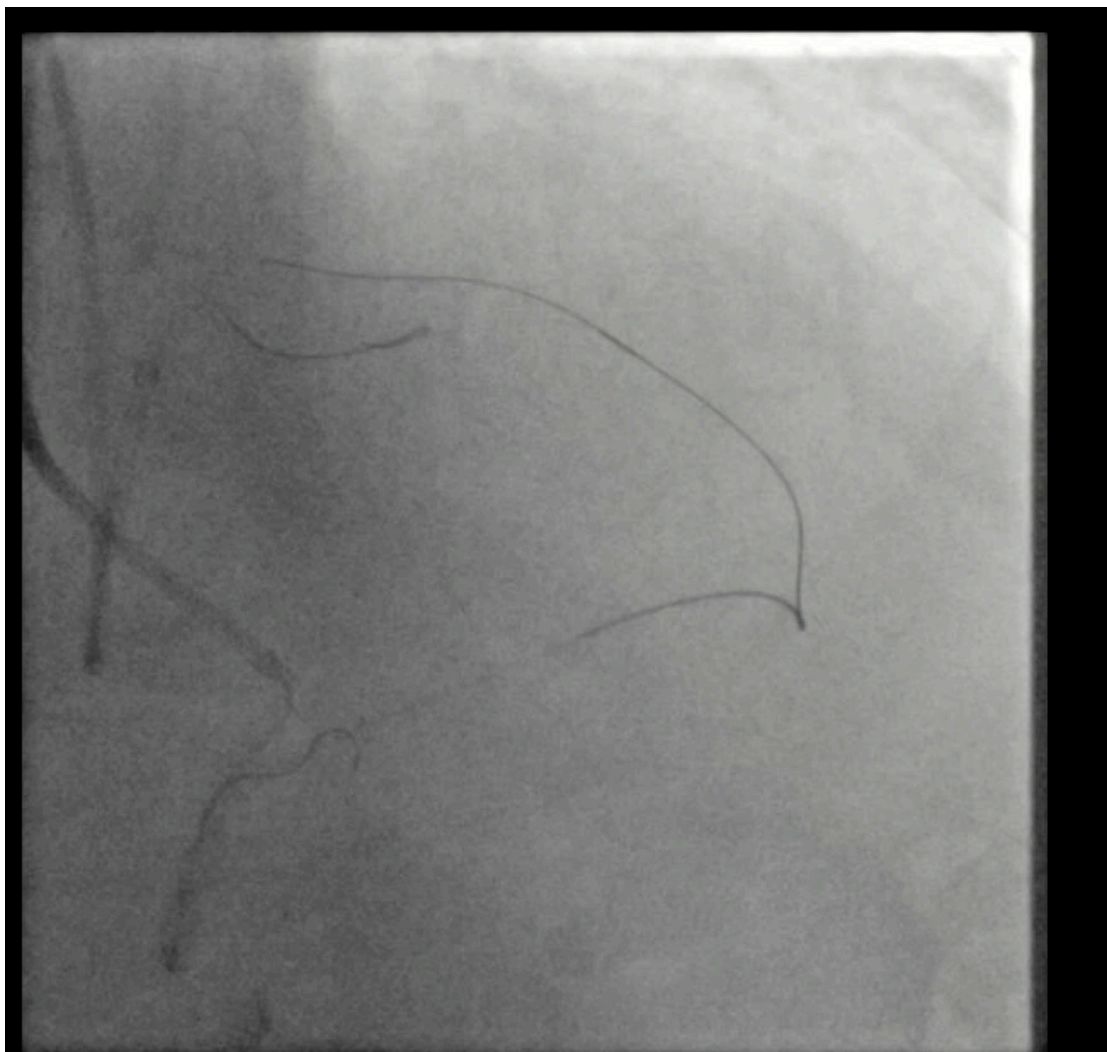


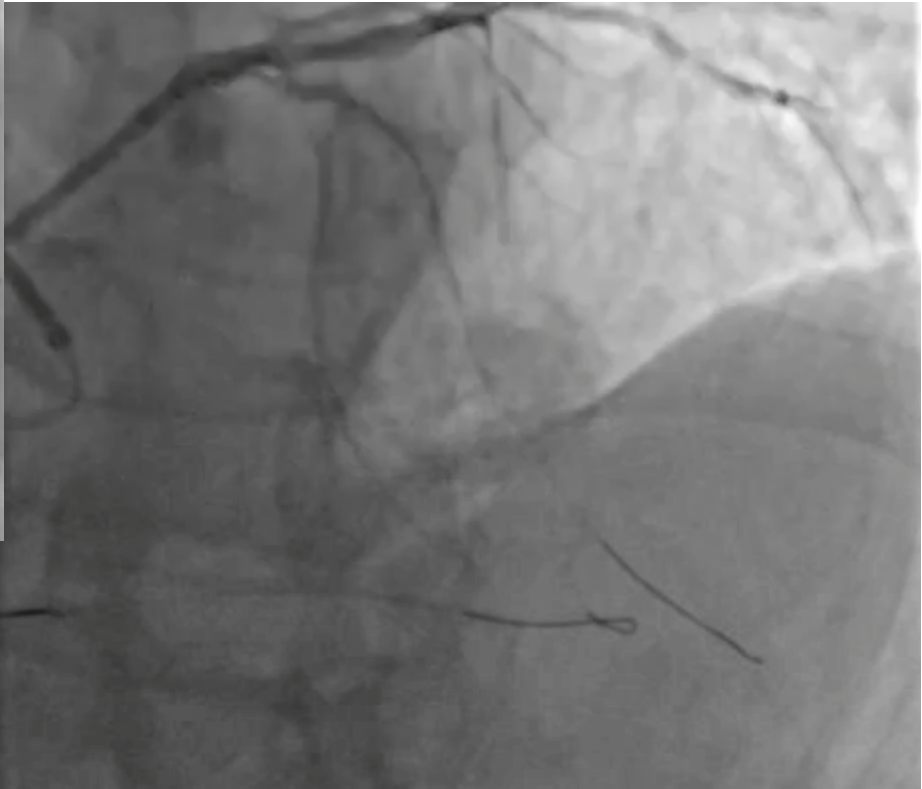
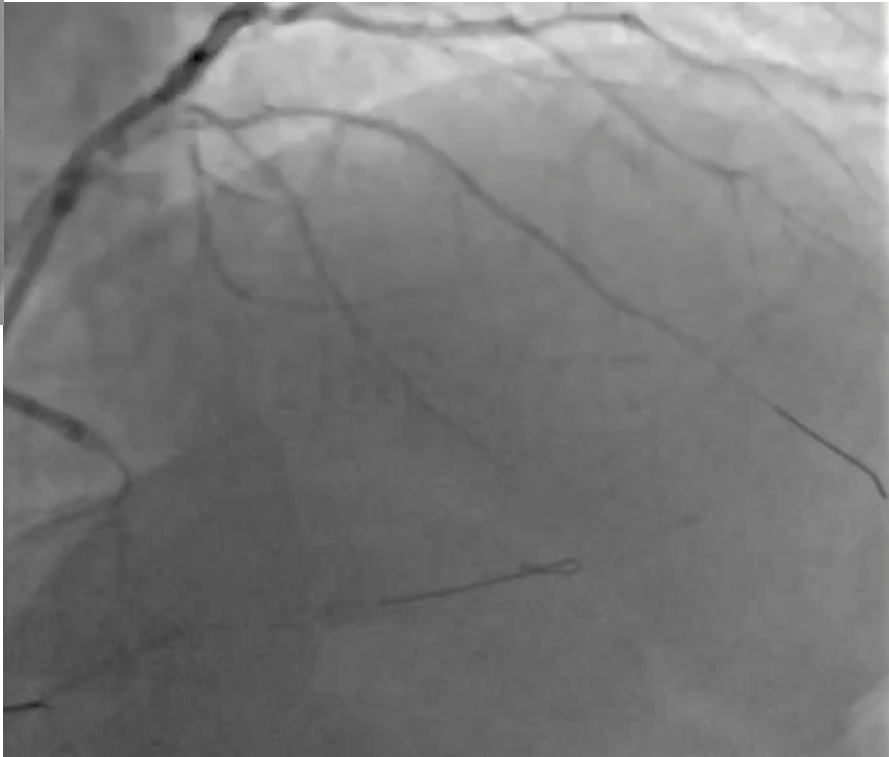
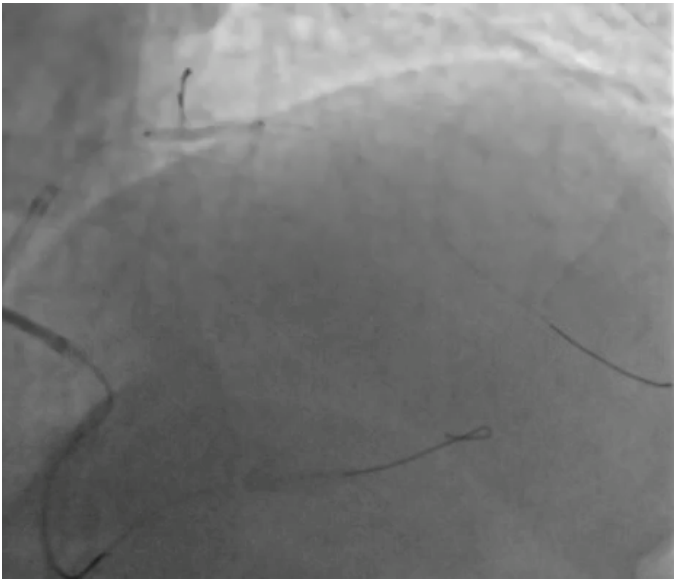




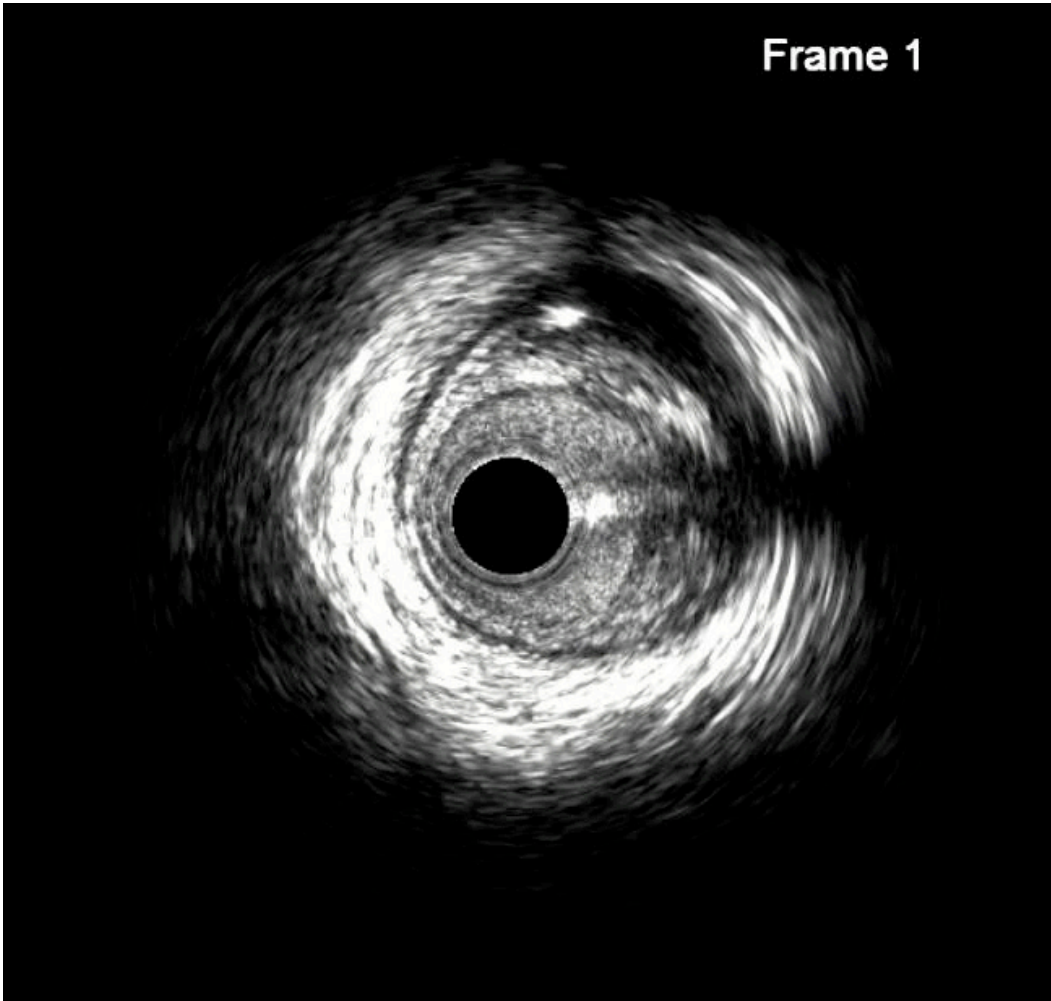
65y M, diabete





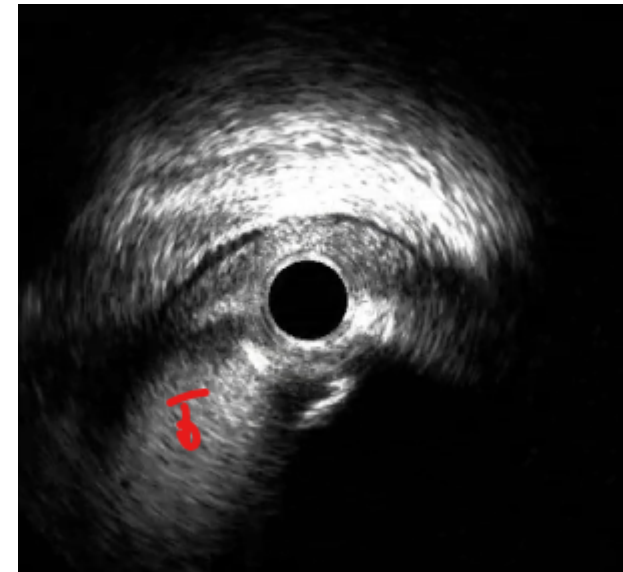
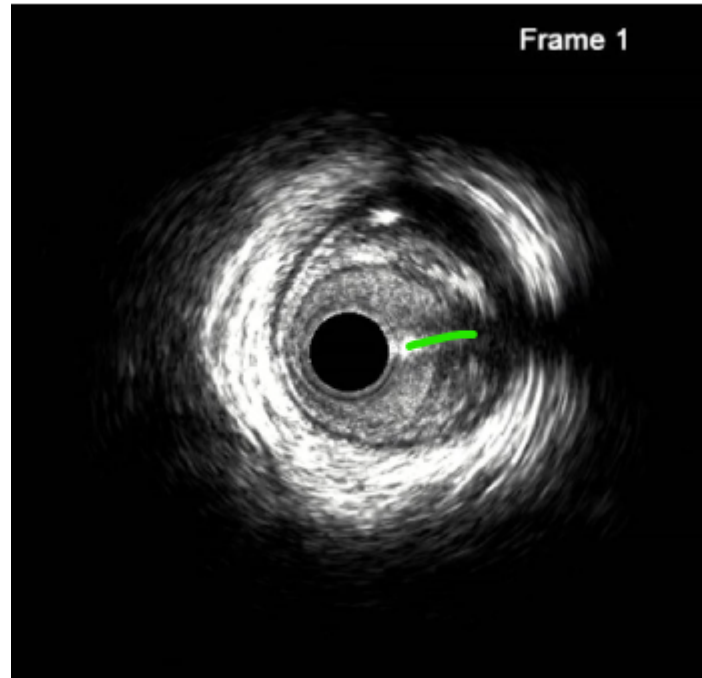


Frame 1

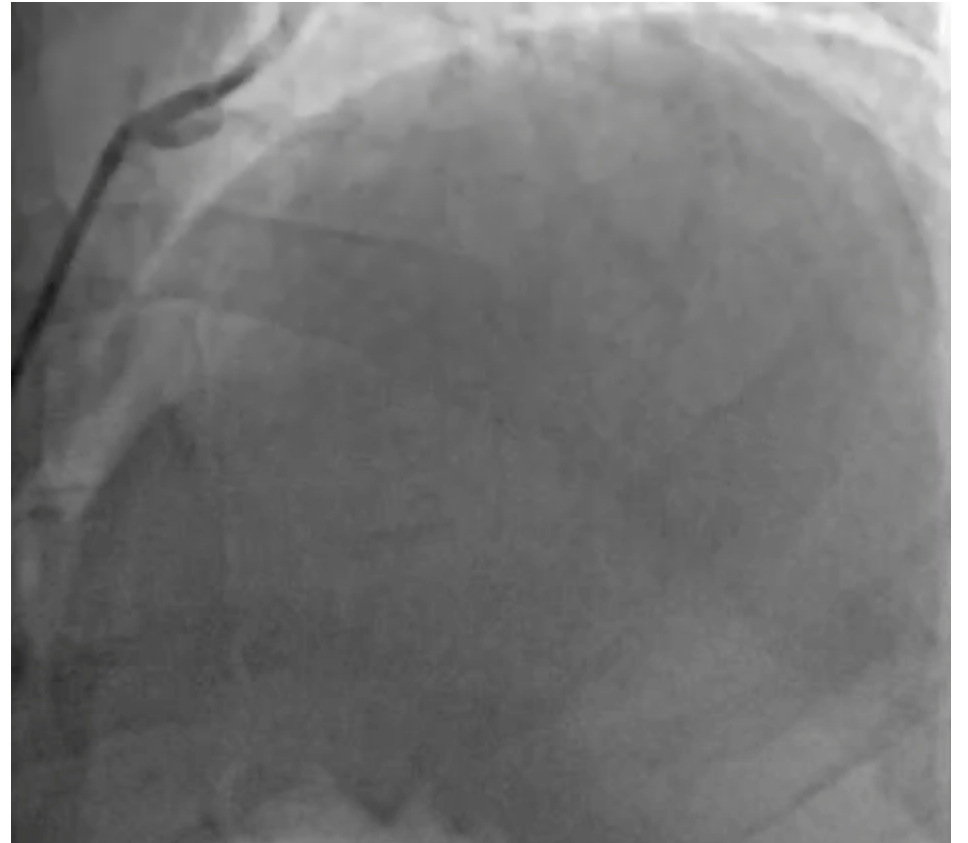
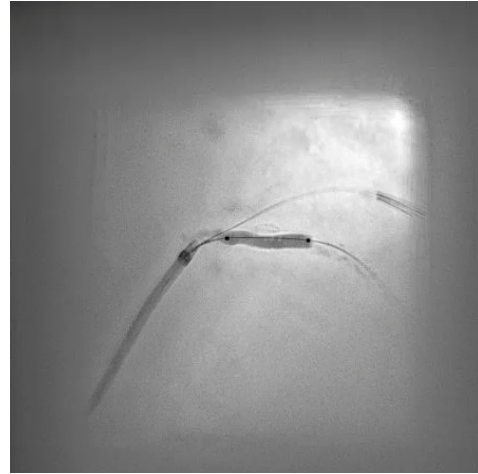
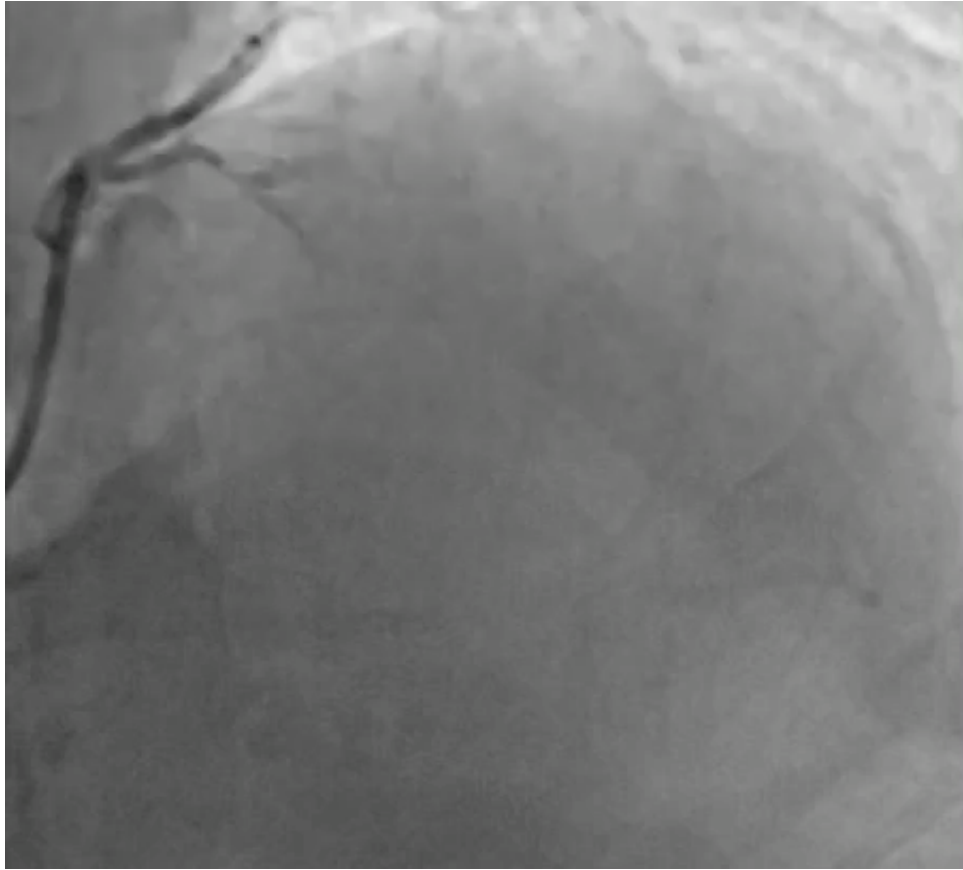


Check retrograde wire correctly
in lumen

Frame 1



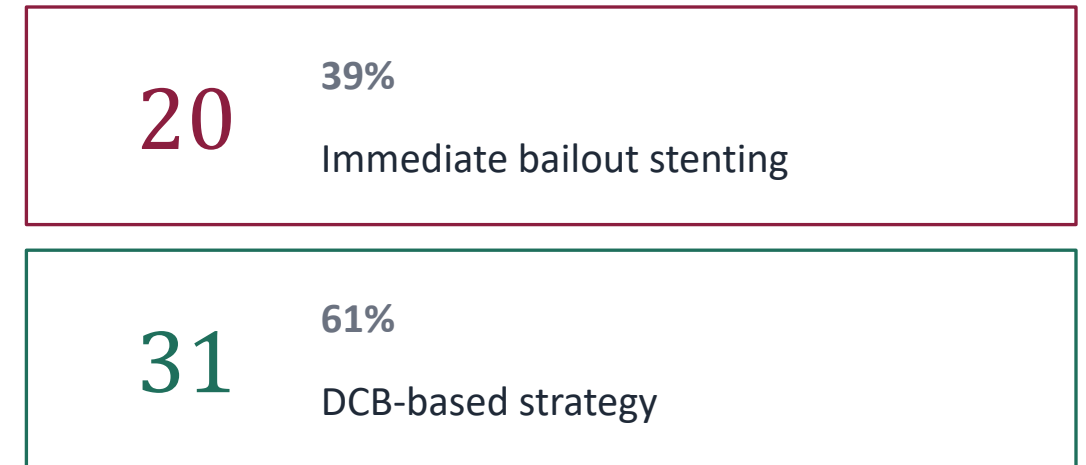
3 month FU



Patient Flow



Within the HR-SF cohort (n = 51)



DCB-based (n = 31) further divided:

- DCB-only — 6 patients
- **INVEST-DCB (staged) — 25 patients**

Baseline Characteristics INVEST-DCB Cohort (n = 25)

Demographics	
Age (years, mean $\pm$ SD)	69 $\pm$ 10
Male	88 %
Hypertension	96 %
Dyslipidemia	92 %
Diabetes mellitus	29 %
Prior MI	42 %
Prior PCI	25 %
Prior CABG	8 %

Lesion features	
Multivessel disease	58 %
SYNTAX score (mean $\pm$ SD)	25.7 $\pm$ 10
CTO location — RCA	56 %
CTO location — LAD	32 %
CTO location — LCx	12 %
In-stent restenosis CTO	21 %
J-CTO score (mean)	2.32

Diffuse, complex, predominantly RCA disease with moderate-to-high lesion complexity.

Angiographic Vessel Evolution at 3 Months

INVEST-DCB cohort, n = 25

5

20 %

Re-occlusion

asymptomatic
→ DES implantation

8

32 %

Spontaneous healing

luminal improvement
→ no further treatment

12

48 %

Stable suboptimal

planned redo-DCB
as per staged protocol

Outcome at 9 Months & Final Result

Redo-DCB subgroup (n = 12)

9 36 %
Definitive DCB-only success

3 12 %
Required **focal** DES

Leave-nothing-behind

17 / 25

68 %

of the staged INVEST-DCB cohort

Across all HR-SF patients (n = 51): **permanent stenting reduced from 88 % → 55 %** (*≈ 37 % relative reduction*)

We should start thinking of
percutaneous coronary artery
treatment as **healing the vessel**,
rather than chasing the largest lumen
or the best-looking
angiographic result.

