Managing LM ISR

- Case Based Approach -

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Managing of LMT-ISR

There is NO nautical chart in this SEA

NO Strong Evidence No default Strategy

Managing of LMT-ISR

1. Long-Term Prognostic Impact of Restenosis of the Unprotected Left Main Coronary Artery Requiring Repeat Revascularization

   Jens Wiebe, Adnan Kastrati et al J Am Coll Cardiol Intv 2020;

Mortality after TLR for left main stent failure is high. Patient-related factors seem to have a greater impact on mortality after TLR than other variables.

2. Incidence and Management of Restenosis After Treatment of Unprotected Left Main Disease With Drug-Eluting Stents 70 Restenotic Cases From a Cohort of 718 Patients: FAILS (Failure in Left Main StudyA comparison between drug-eluting stent implantation and drug-coated balloon angioplasty in patients with left main bifurcation in-stent restenotic lesions

   Imad Sheiban, Alaide Chieffo, Antonio Colombo ,Jonathan Tobis, Claudio Moretti et al
   J Am Coll Cardiol 2009

DES restenosis in the ULM artery can be managed in most cases with a minimally invasive approach, achieving favorable early and late results.

Managing of LMT-ISR

3. Incidence and Management of Restenosis After Treatment of Unprotected Left Main Disease With Second-Generation Drug-Eluting Stents (from Failure in Left Main Study With 2nd Generation Stents -Cardiogroup III)

Fabrizio D'Ascenzo, Antonio Colombo, et al Am J Cardiol 2017

TLR after DES on ULM represents an unfrequent, being increased in IDDM patients and reduced by intravascular ultrasound. Impact on prognosis remains neutral, being related to clinical presentation and extent of coronary artery disease.

4. A comparison between drug-eluting stent implantation and drug-coated balloon angioplasty in patients with left main bifurcation in-stent restenotic lesions

Hyungdon Kook et al BMC Cardiovascular Disorders 2020

DES and DCB showed comparable long-term clinical results in patients with LMB-ISR lesions.

Elements to Consider

① Clinical Presentation

Stable AP, ACS, Acute HF→ Supporting device…

② Location of ISR

LM body, LM ostium, LAD just prox, ….

③ Evaluation : Characteristics of ISR

Concentric, Eccentric, Cal., Long diffuse….

④ Selection of Appropriate Device (for PCI)

Stent, DCB, Rota, Diamondback, …..

Elements to Consider

1. Clinical Presentation

Different Degree of Clinical Severity

Acute CS, Acute HF → Supporting device… IABP, IMPELLA

Diffuse ISR in LMT → Supporting device… IABP, IMPELLA

& need high grade skill, Quickness and Quickness

Need precise evaluation of content in ISR

Elements to Consider

2,3,4. Evaluation of ISR & Selection of Device

Different Position and Characteristics of ISR

Position of ISR, Pattern → IVUS, OCT, Cor.CT… IMAGING !!

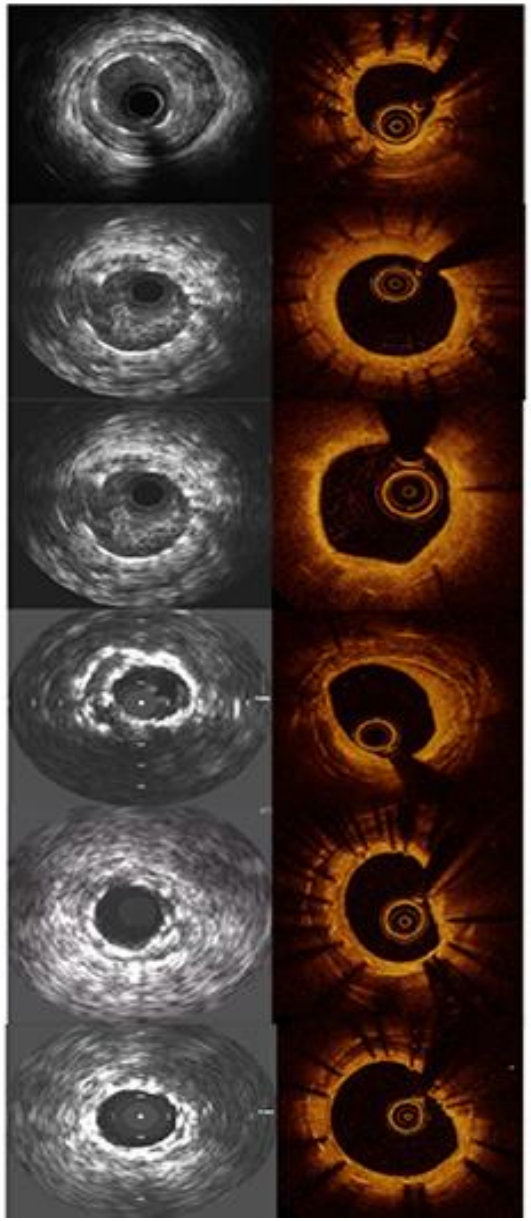
Evaluation of Characteristics → Stent, Balloon, Rota, OAS….

Need high grade skill and Knowledge

Supporting device… if necessary….

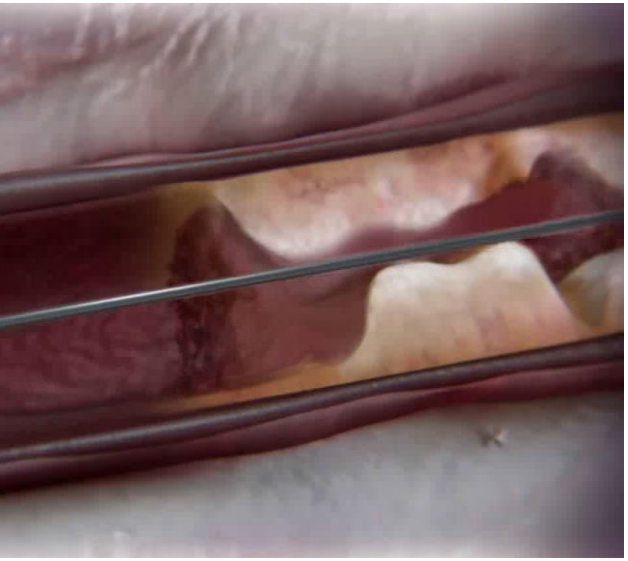
Pattern of LMT-ISR: Waksman In-Stent Restenosis Classification

Type	Definition		Therapeutic Guidance
I	Mechanical	Stent underexpansion (Type I A)	High pressure balloon, ELCA, or IVL. Underexpansion must be treated prior to further stent implantation
		Stent fracture (Type I B)	DES
II	Biologic	Neointimal hyperplasia (Type II A)	Balloon, DCB, DES, or VBT
		Neoatherosclerosis, non-calcified (Type II B)	DCB, or DES
		Neoatherosclerosis, calcified (Type II C)	Scoring balloon, ELCA, OA or RA prior to DES
III	Mixed pattern: Combined mechanical and biologic etiology		High-pressure NC balloon with DCB, DES, or VBT
IV	Chronic total occlusion		DCB or DES; VBT for multiple layers, CABG as needed
V	>2 layers of stent		Balloon, DCB, VBT, or CABG

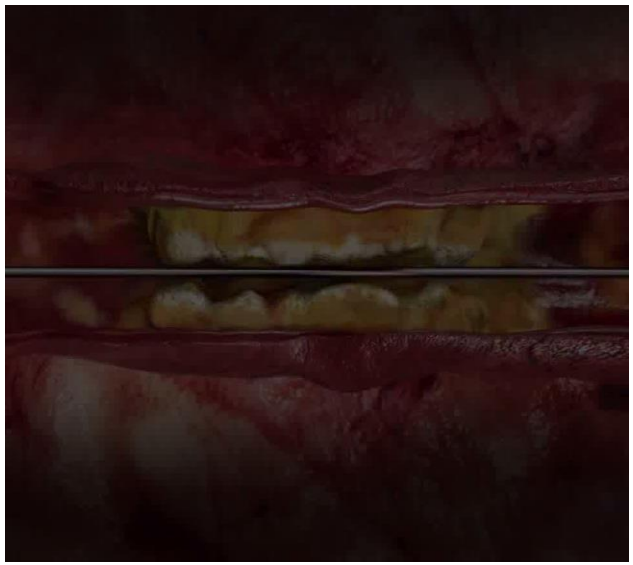


Choice of Debulking Devices and More !!

Diamond Back



ROTA



DCB

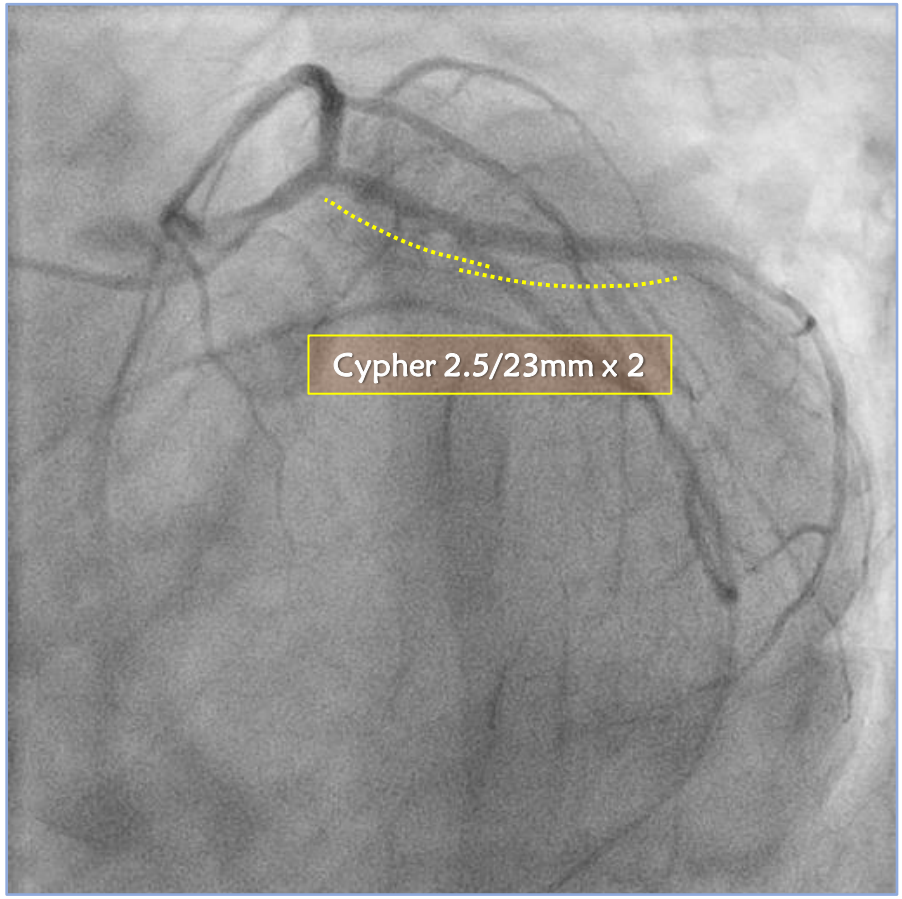
Shock Wave

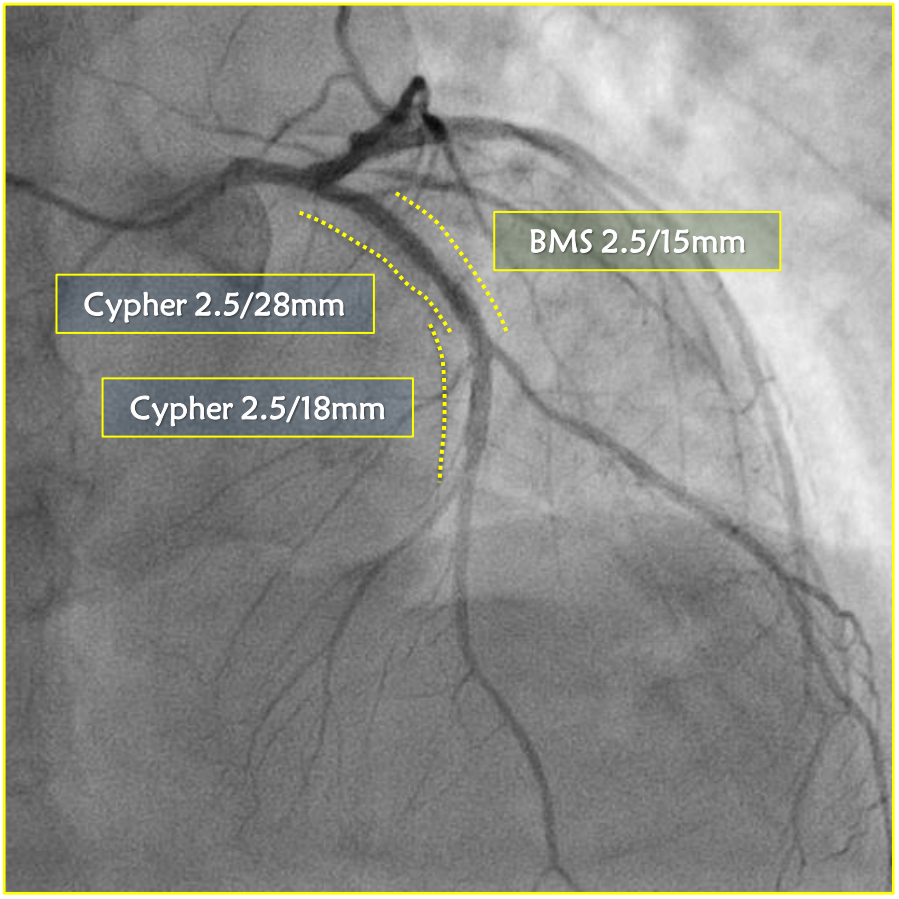
Cutting Balloon

DCA

Case 1 : Severe Restenosis 10 Years after Stenting in LAD just pro, LCX pro.

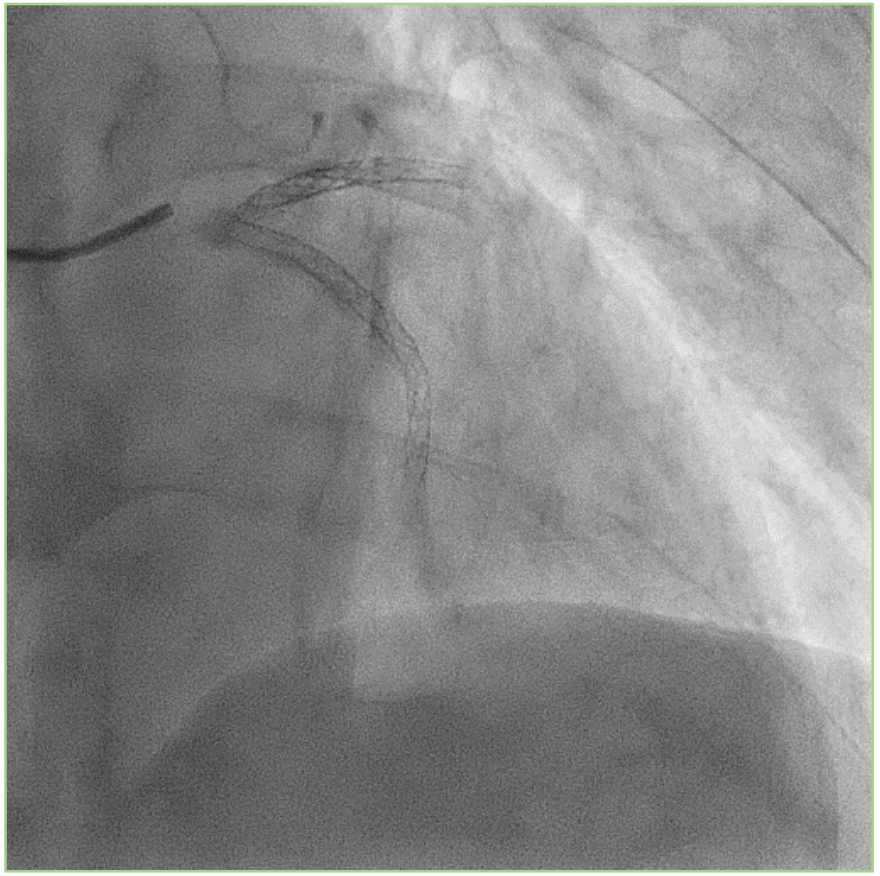
Details of previous stents implanted (2005~2006) **LMT ; NO STENT**



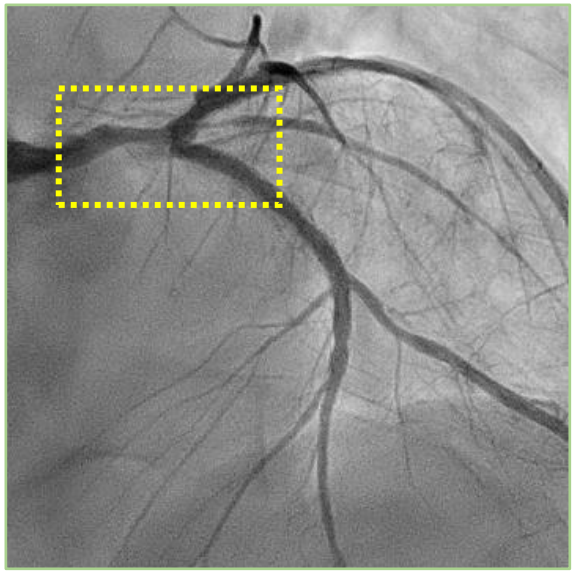


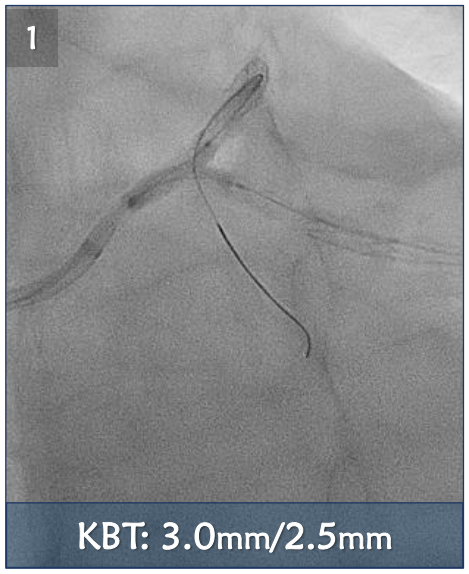
Case 1 : 70s Male; UAP, Severe Restenosis 10 Years after PCI

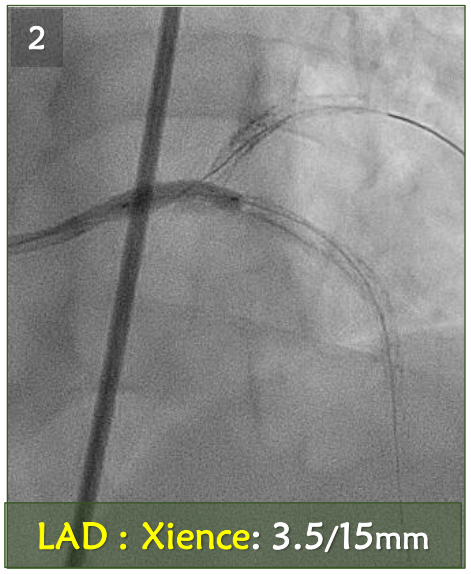
UAP with big Chest Pain, (Jan. 2016) LMT distal true bifurcation Stenosis : ISR

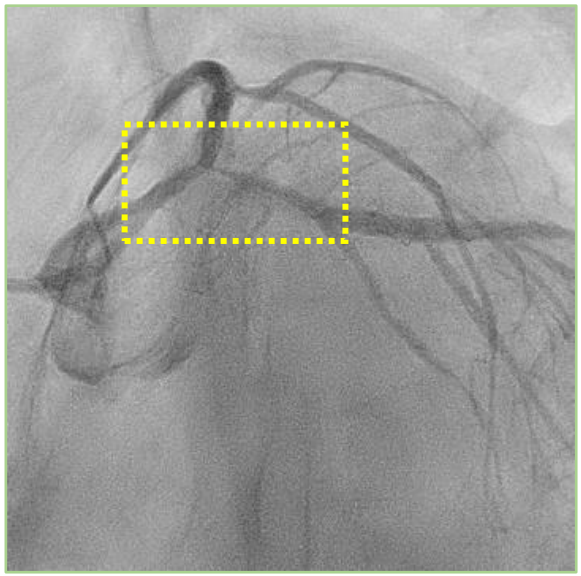


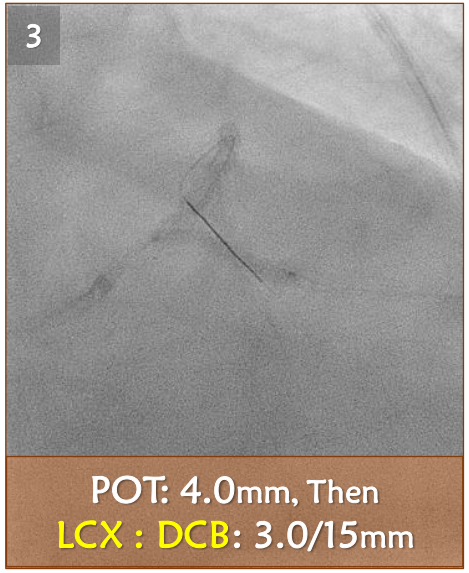
Case 1 : Severe Restenosis Stenting in LAD just pro, LCX pro.

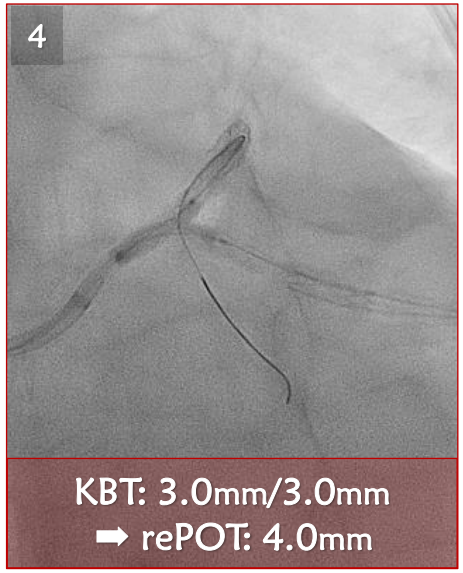






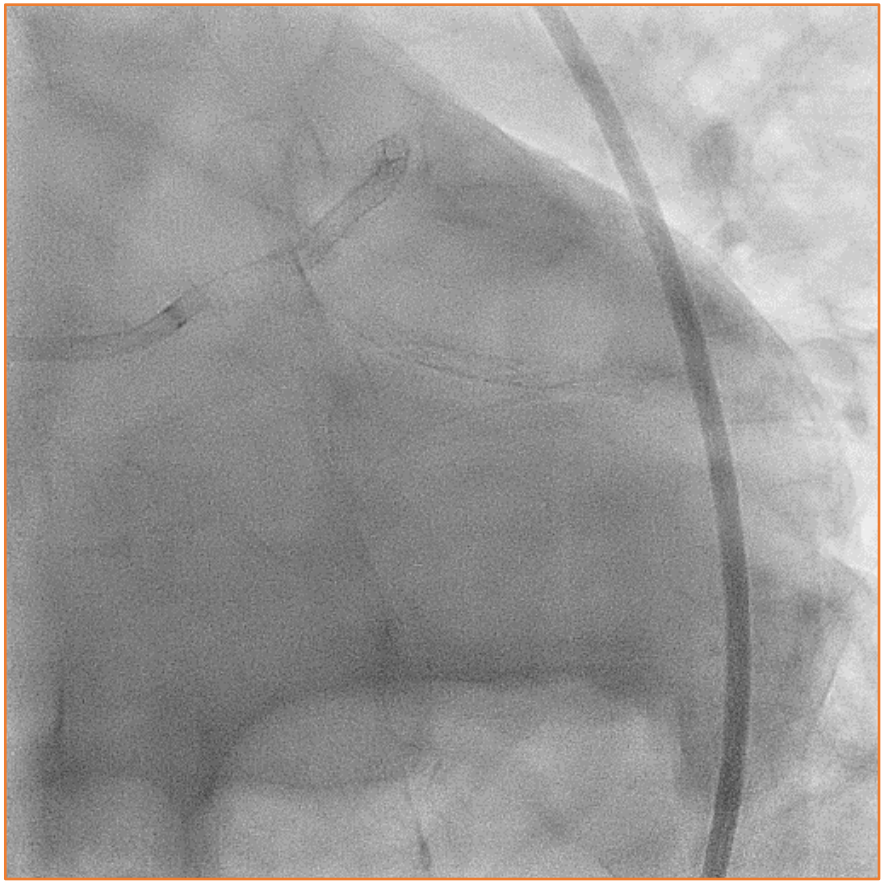


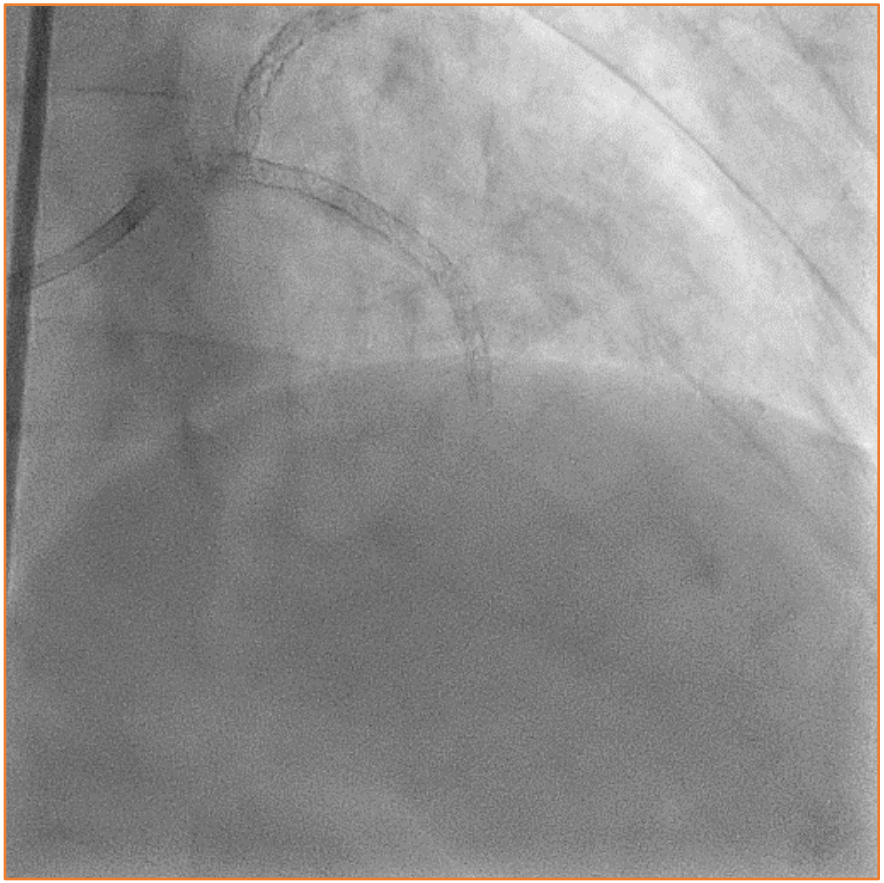




Case 1 : Severe Restenosis Stenting in LAD just pro, LCX pro.

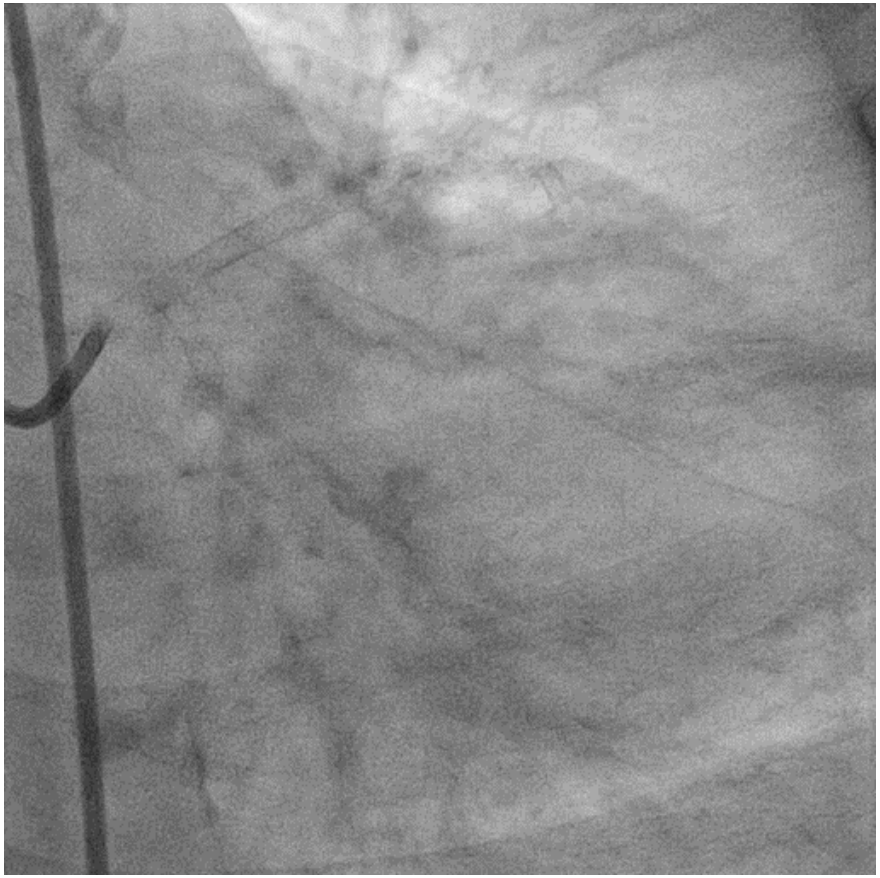
Final Angiogram





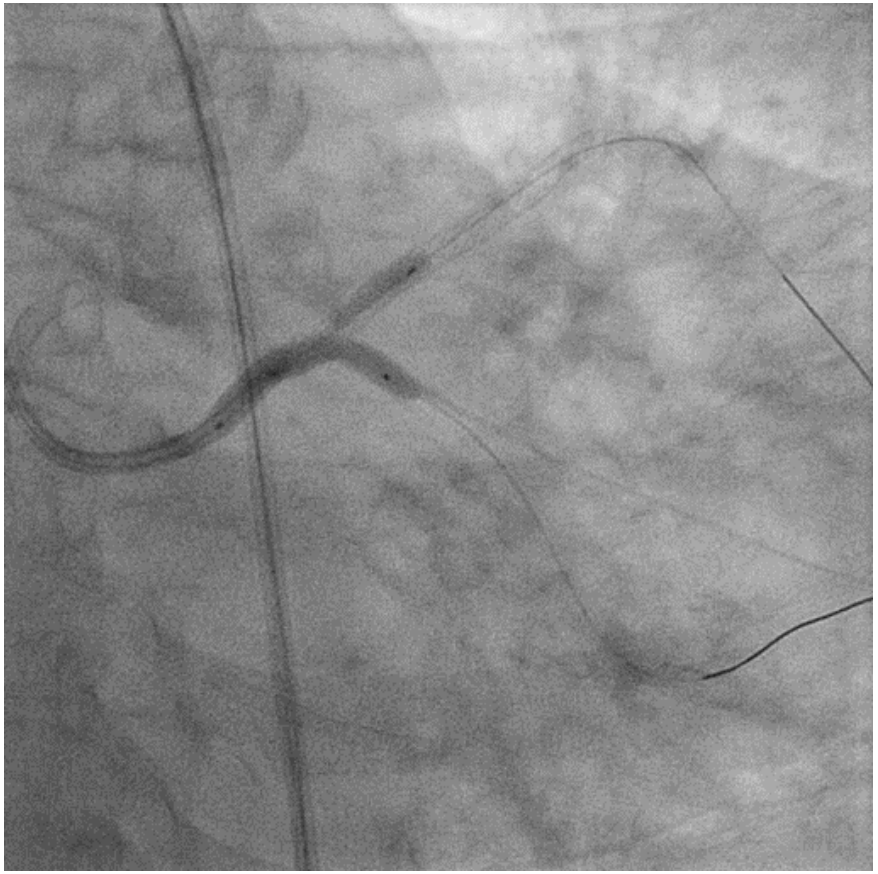
Case 2 : 60's Female ; U-AP: Severe Restenosis 4 years after TAP Stenting

UAP, Severe Restenosis 4 years after TAP Stenting



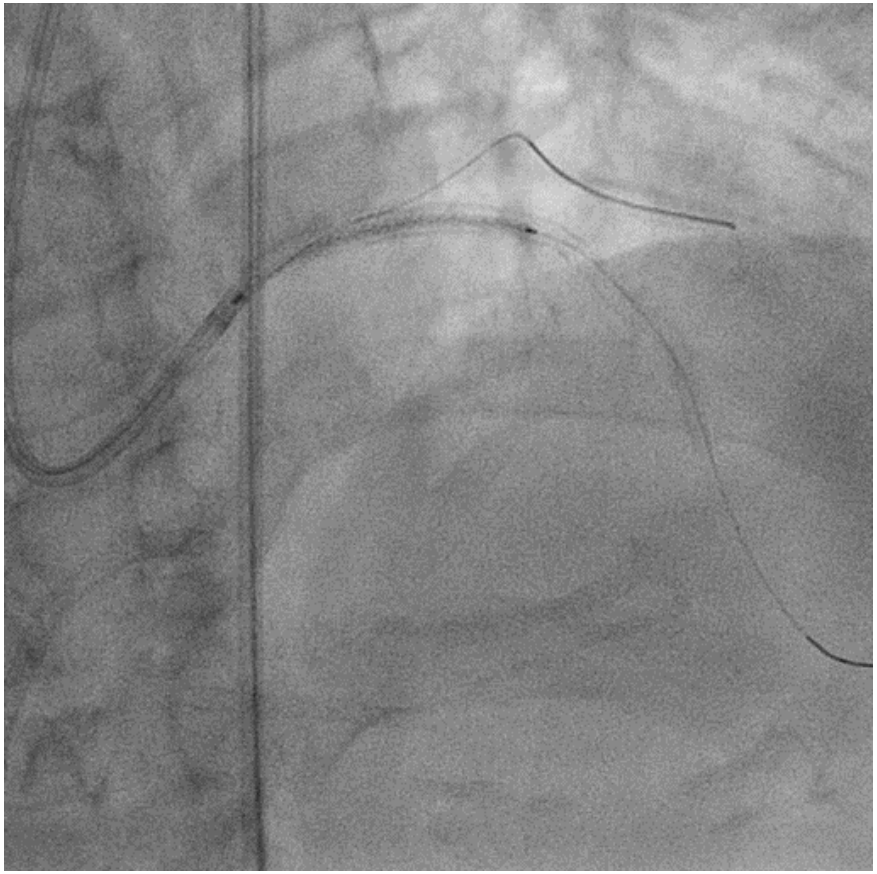
Case 2 : 60's Female ; U-AP: Severe Restenosis 4 years after TAP Stenting

Concentric Hyperplasia in LMT



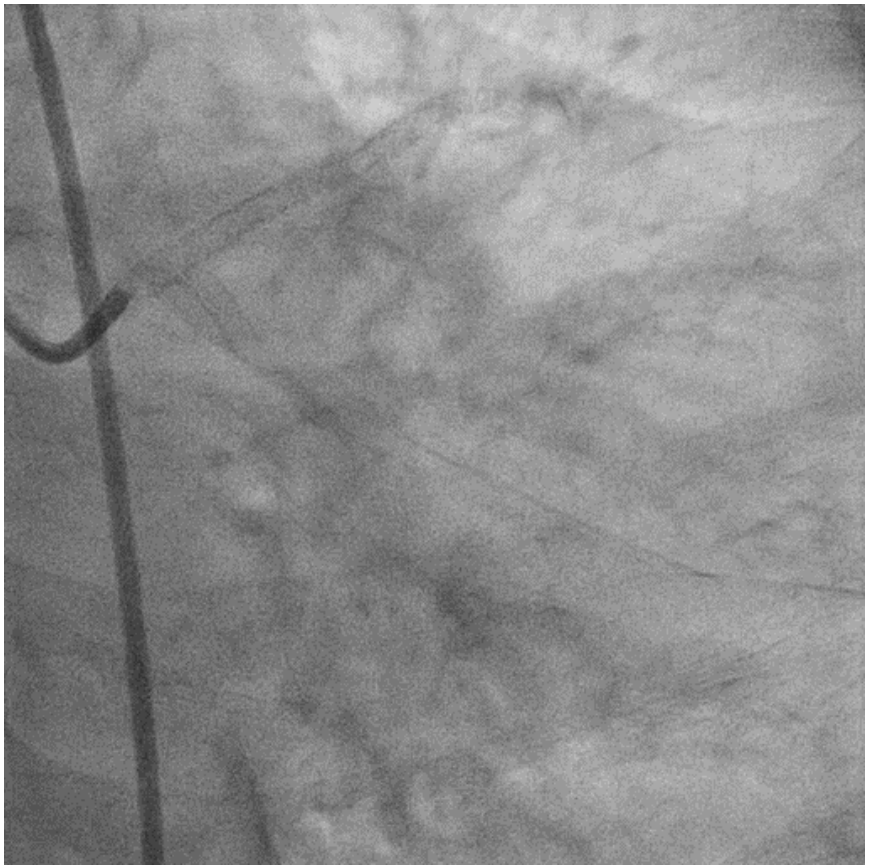
Stenting;

because we need quick revascularization !!

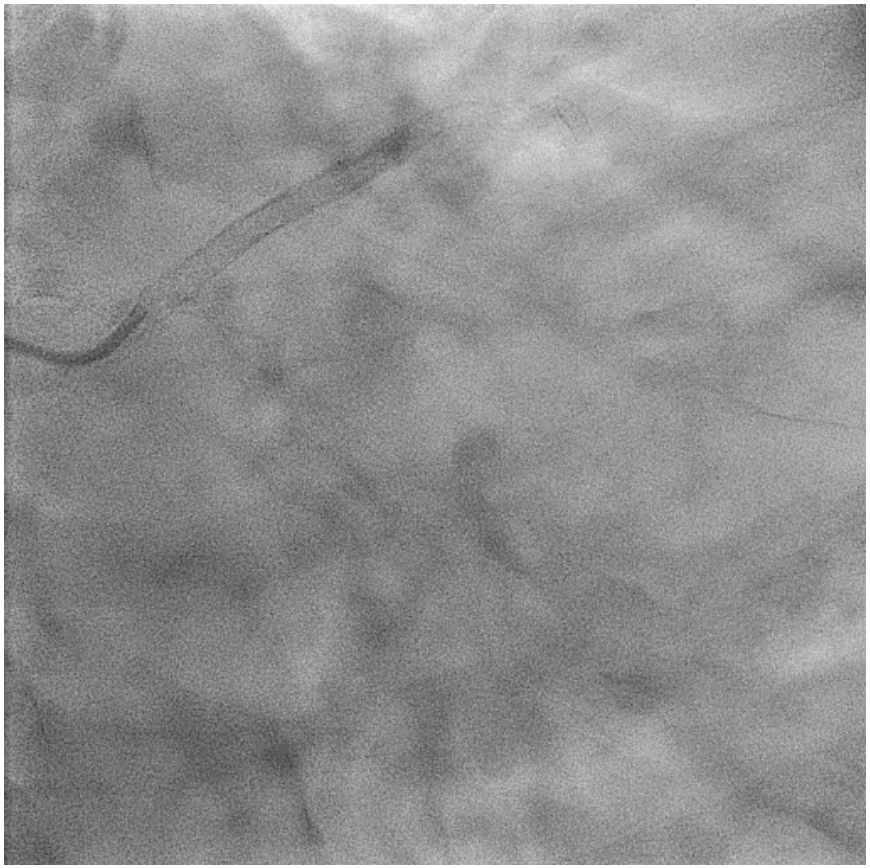


Case 2 : 60's Female ; U-AP: Severe Restenosis 4 years after TAP Stenting

Final Angio.



Another 4 Years Later



Case 3 : 70's Male, ; ISR CTO after Mini DK crush stenting in LMT

Severe trifurcation stenosis in LMT bifur.

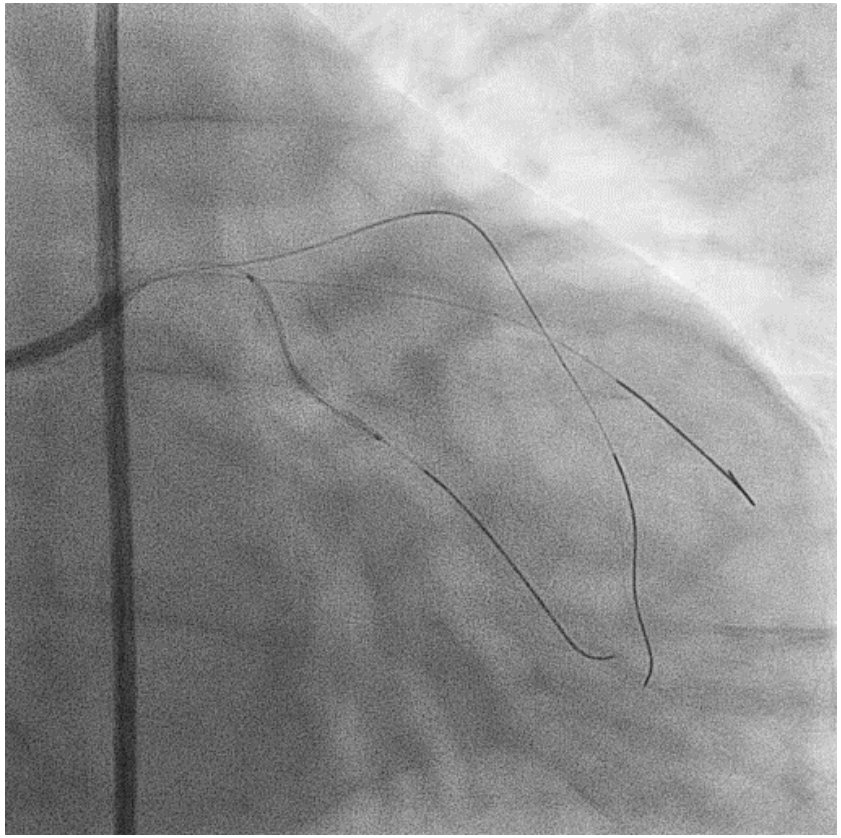
1. 70' old male Unstable Angina

2. LMT trifurcation stenosis

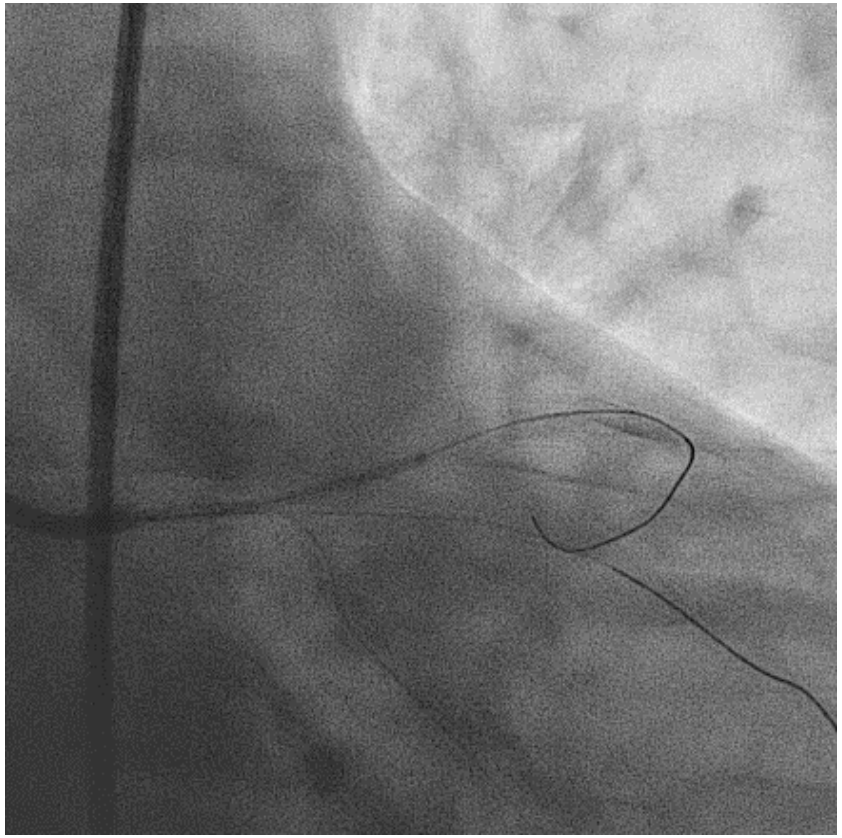
3. For secure…
   thinking the order of stenting

Case 3 : 70's Male, ; ISR CTO after Mini DK crush stenting in LMT

GW to 3V and Stenting in LCX

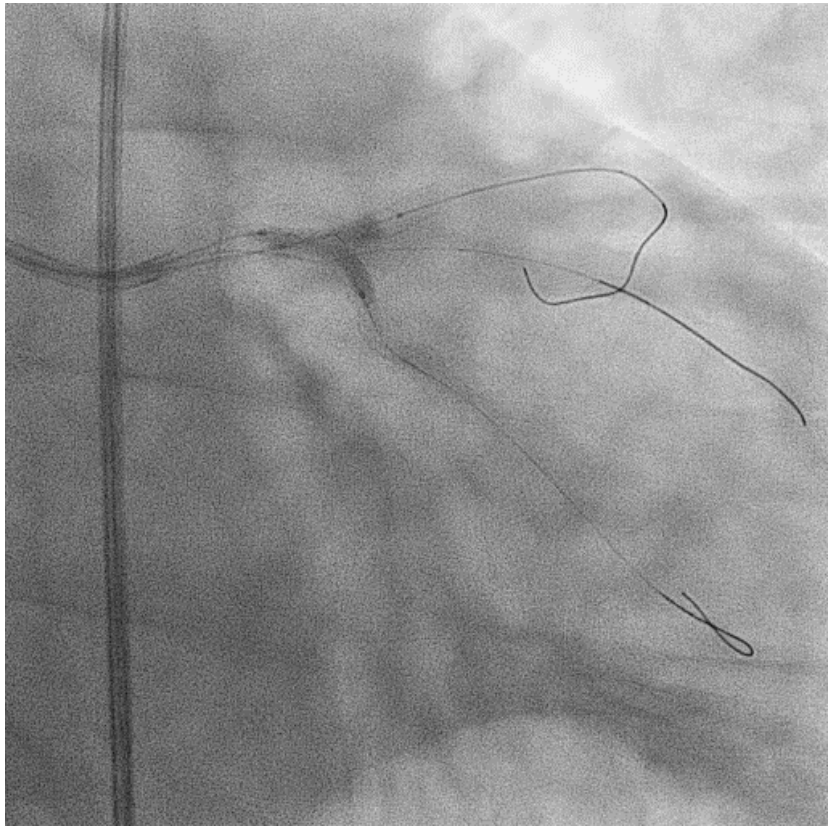


Then, LAD stenting

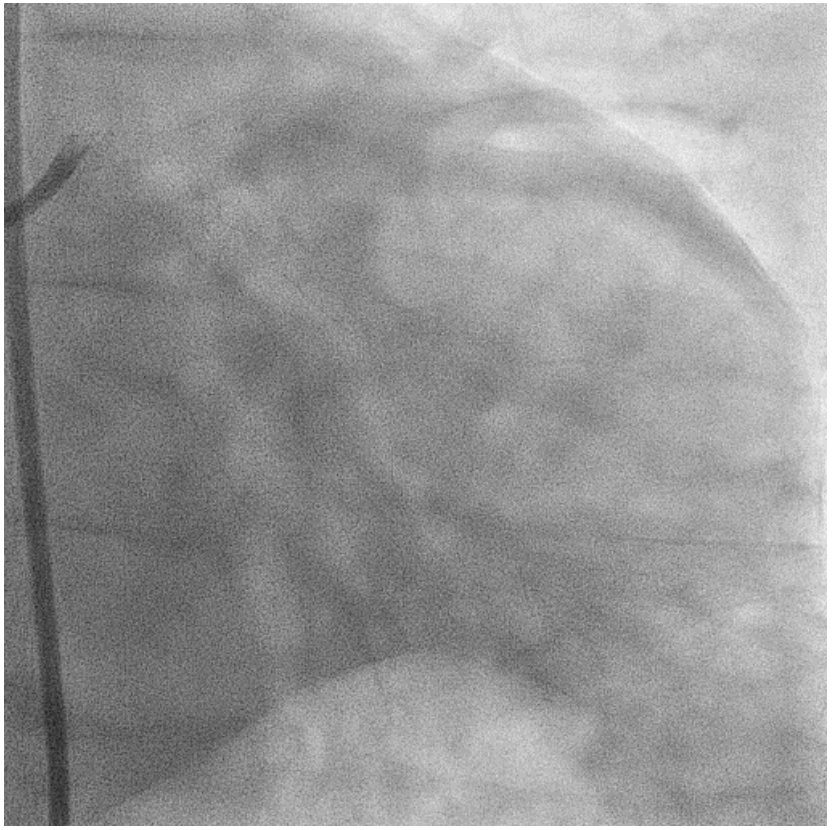


Case 3 : 70's Male, ; ISR CTO after Mini DK crush stenting in LMT

KBT

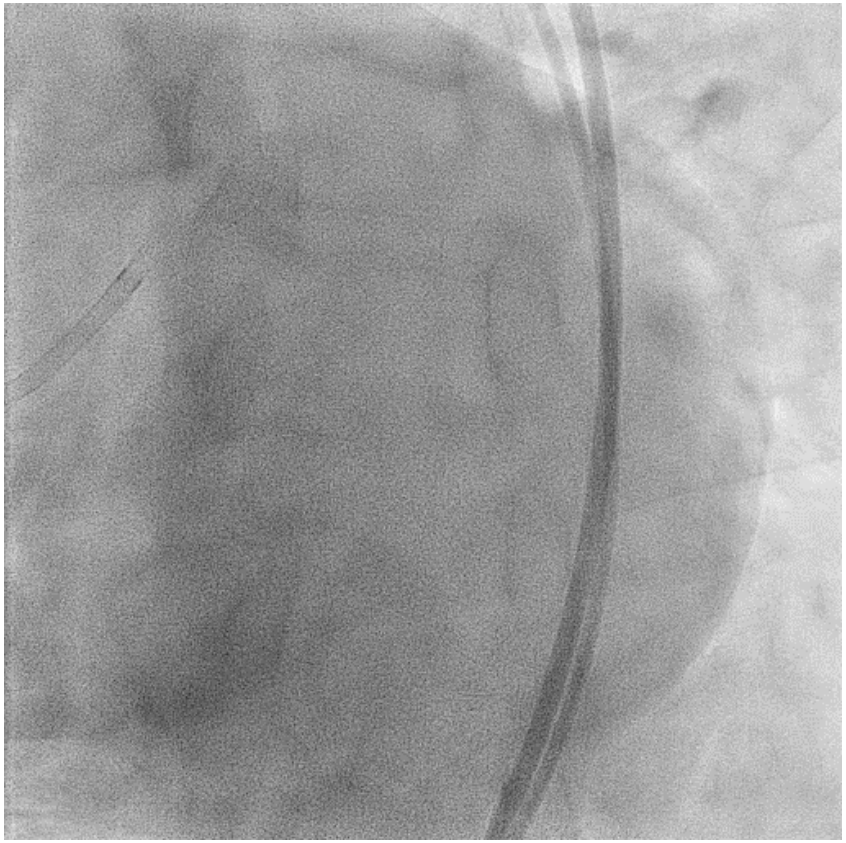


Final Angio



Case 3 : 70's Male, ; ISR CTO after Mini DK crush stenting in LMT

1 year later… SAP but CAG shows…



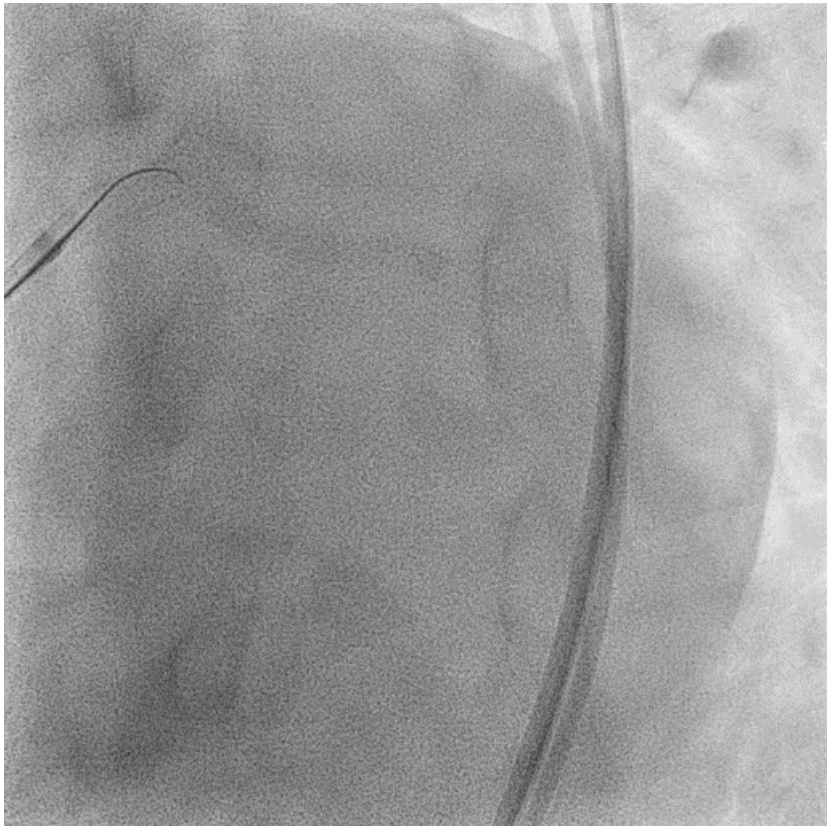
1. 70' old male SAP with LCX ISR-CTO

2. Can see stent strut but, NO STUMP

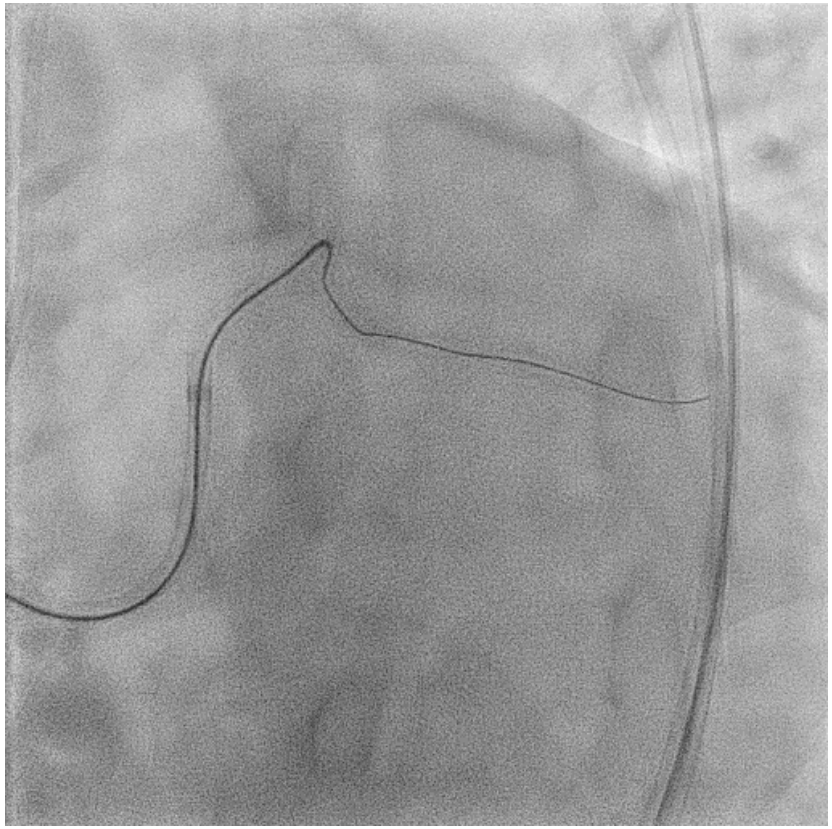
3. For Retro-grade angio…
   can see 2 cm ISR CTO

Case 3 : 70's Male, ; ISR CTO after Mini DK crush stenting in LMT

Antegrade Approach with GAIA 2

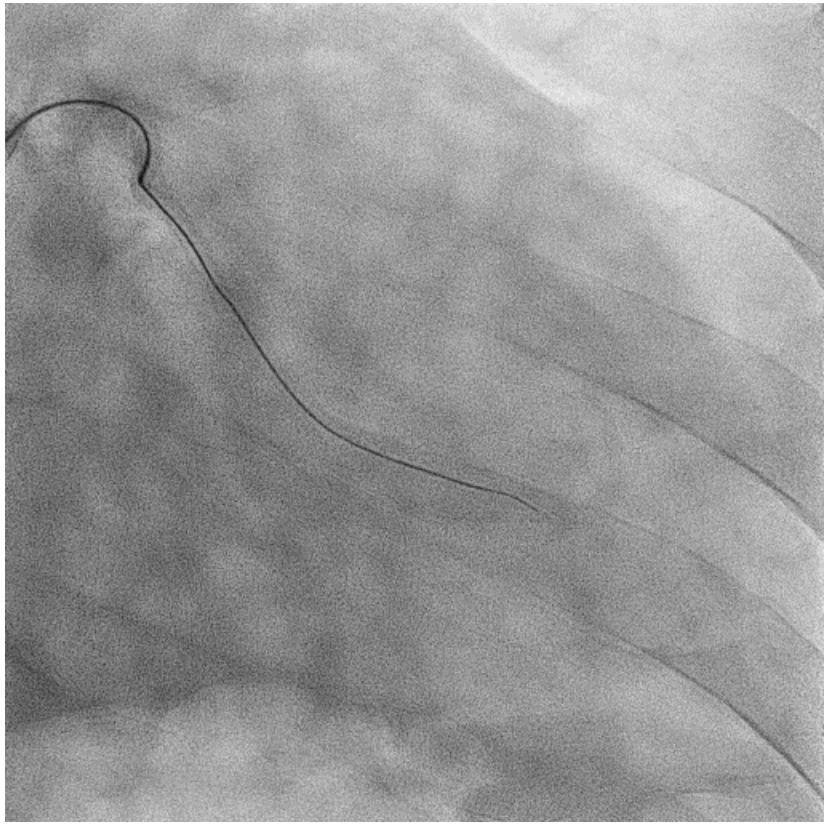


With sophisticated tech. GW passed through..

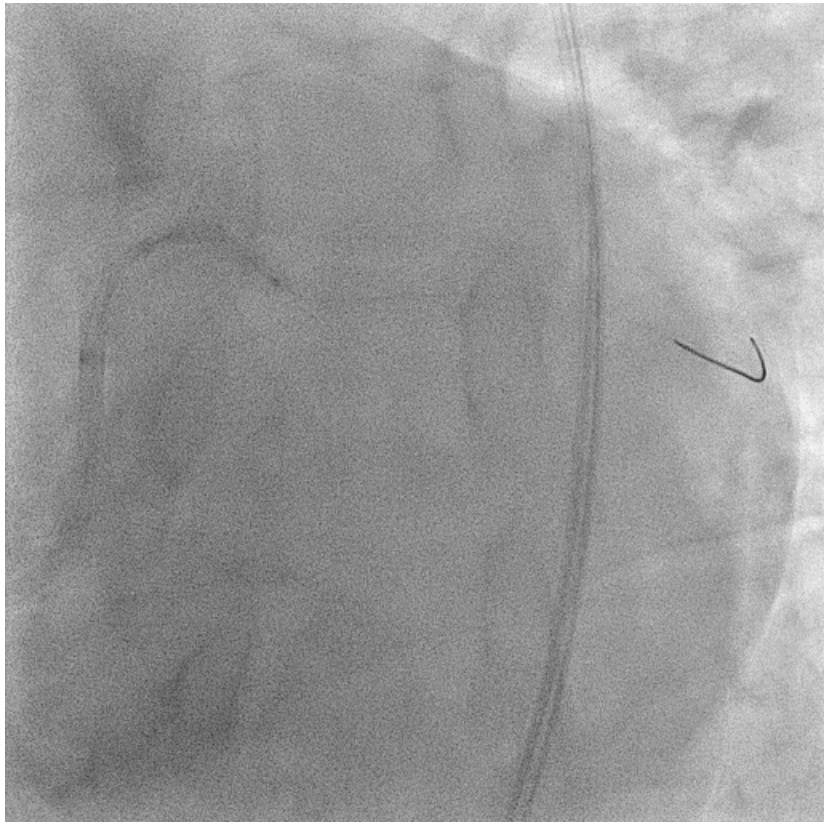


Case 3 : 70's Male, ; ISR CTO after Mini DK crush stenting in LMT

GW reached to distal…

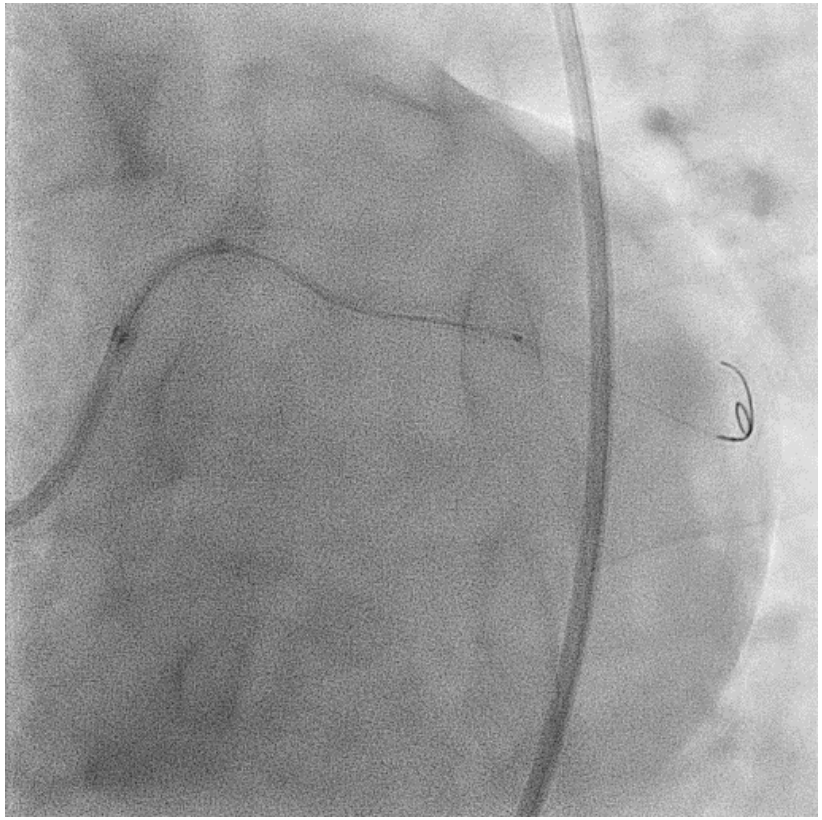


Because of severe angle, some difficulty for delivering balloon, the GC extent.

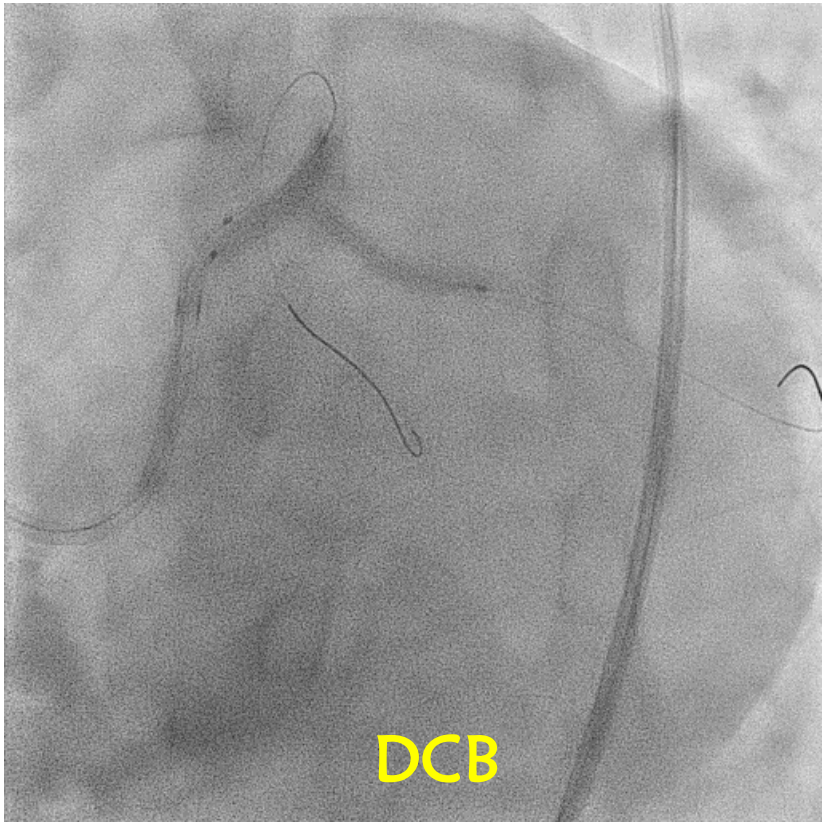


Case 3 : 70's Male, ; ISR CTO after Mini DK crush stenting in LMT

After ballooning, checked with OCT…

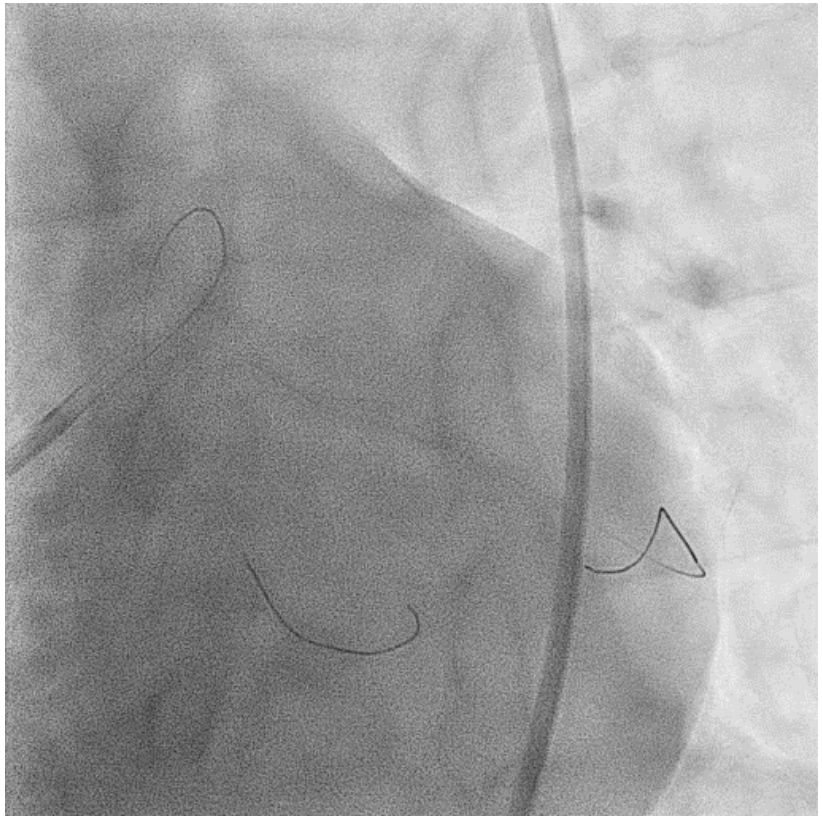


KBT with DCB….



Case 3 : 70's Male, ; ISR CTO after Mini DK crush stenting in LMT

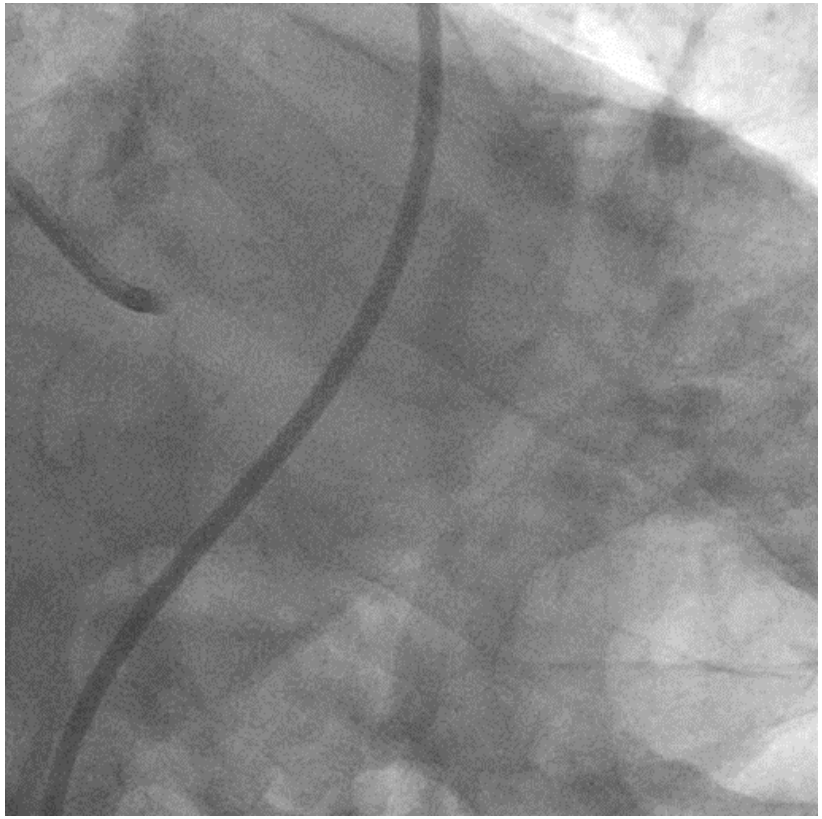
Final Angiogram



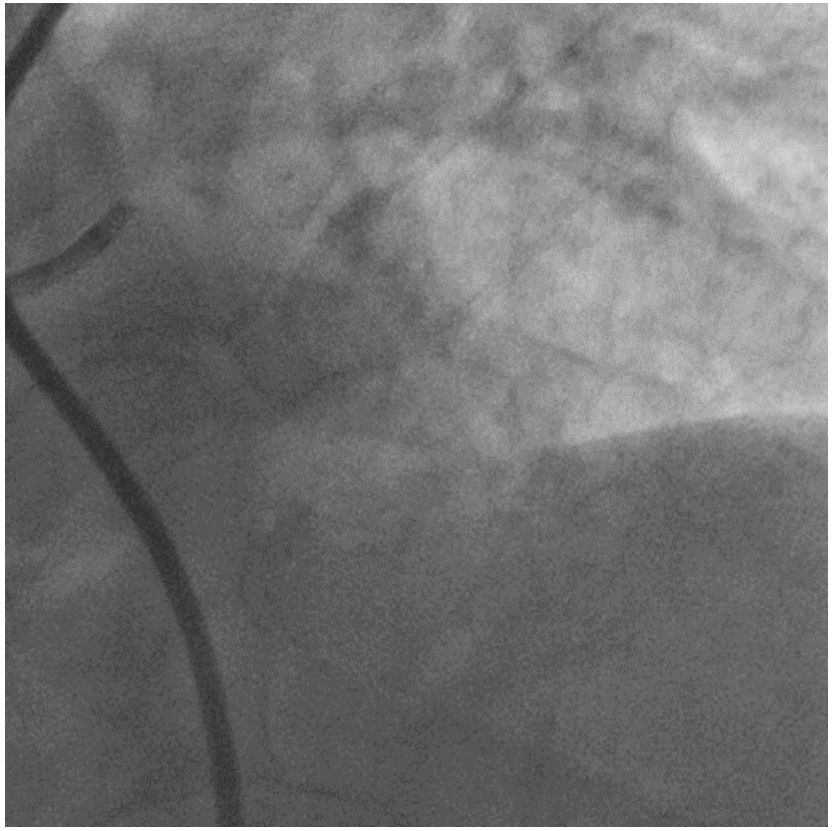
Case 4 : 80's Male, ; Severe ISR in LCX after Culotte Stenting in LMT

Baseline

LMT~LAD, LCX diffuse lesion



Diseased Coronary Artery in LAD



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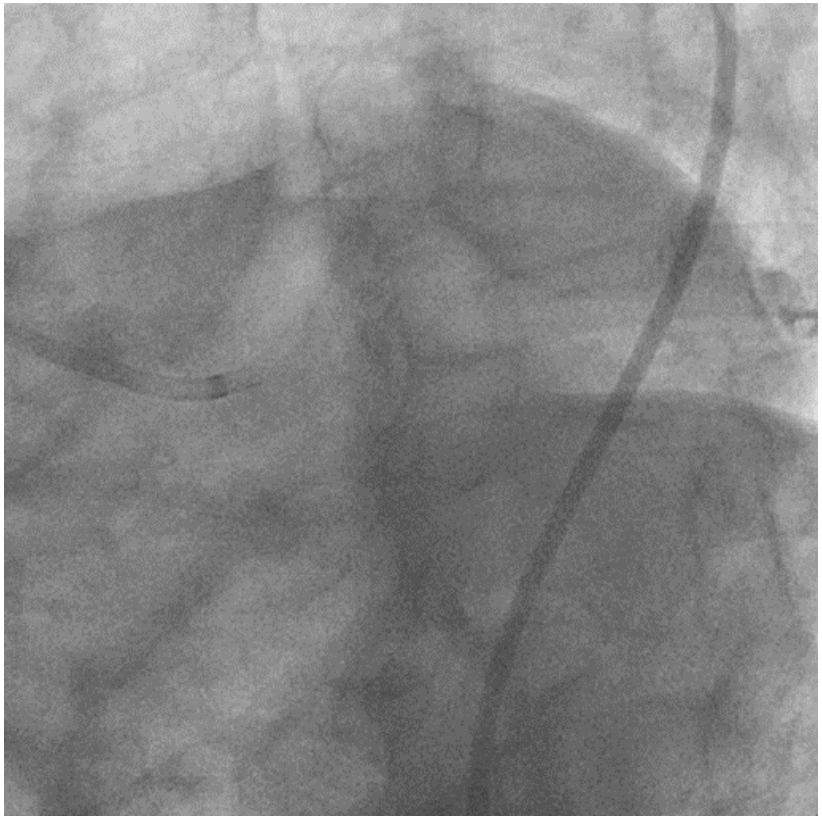
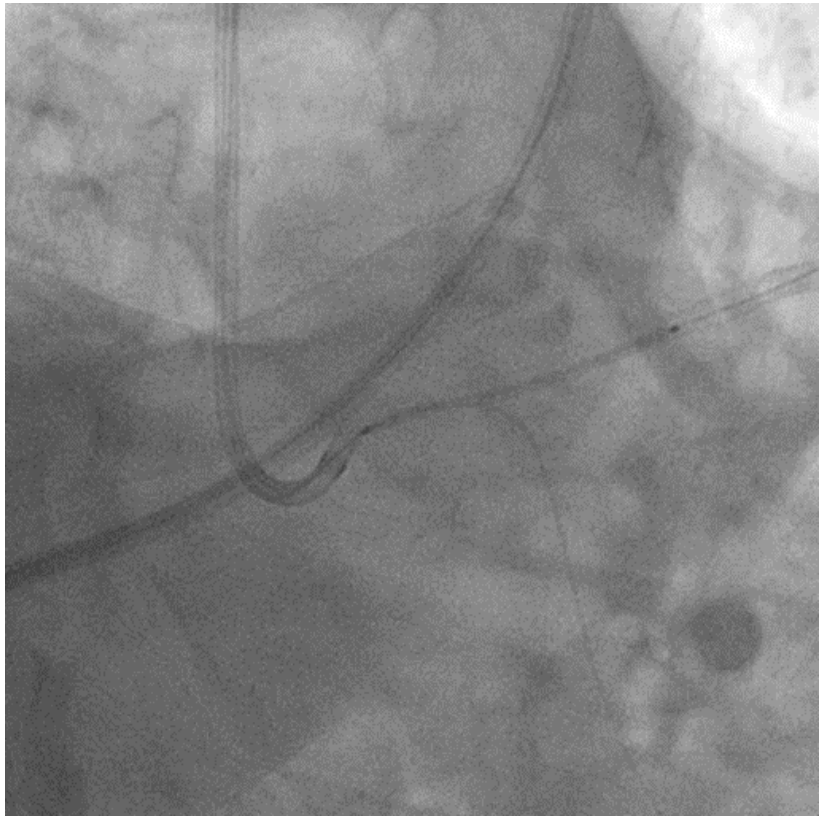
Baseline ; LMT~LAD, LCX diffuse lesion

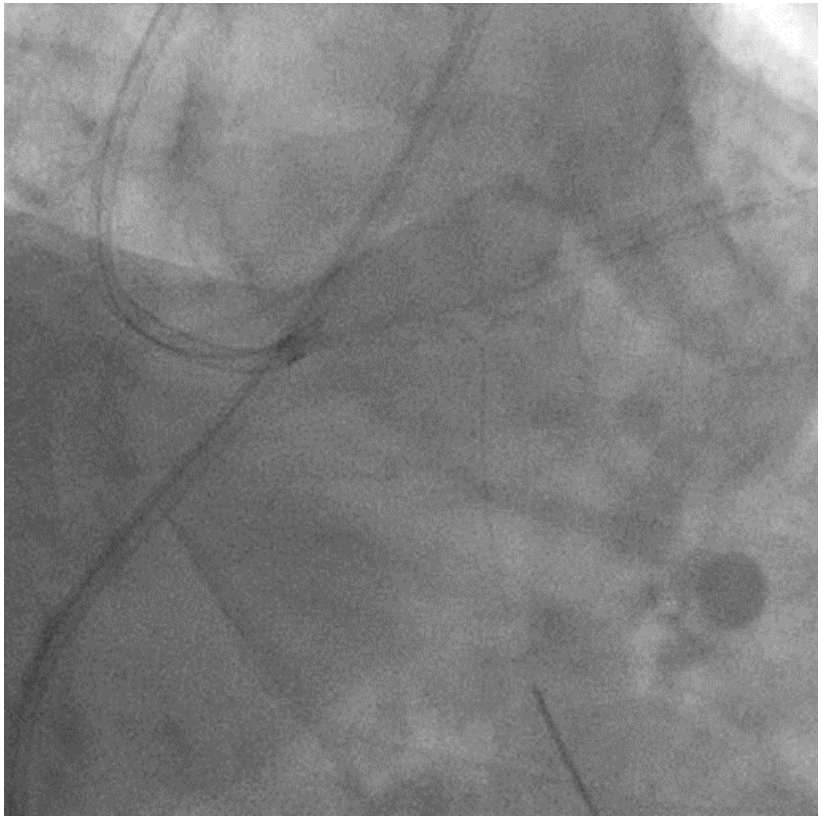


LMT~LAD stenting with Gw-ing in LCX

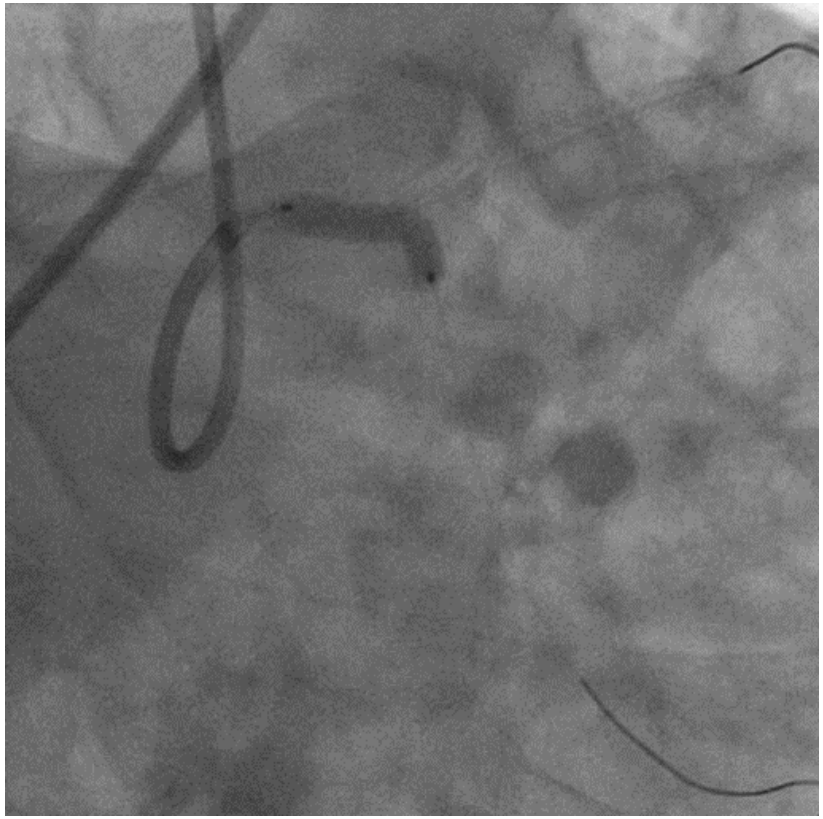


Case 4 : 80's Male, ; Severe ISR in LCX after Culotte Stenting in LMT

POT and Optimization in LMT and recross

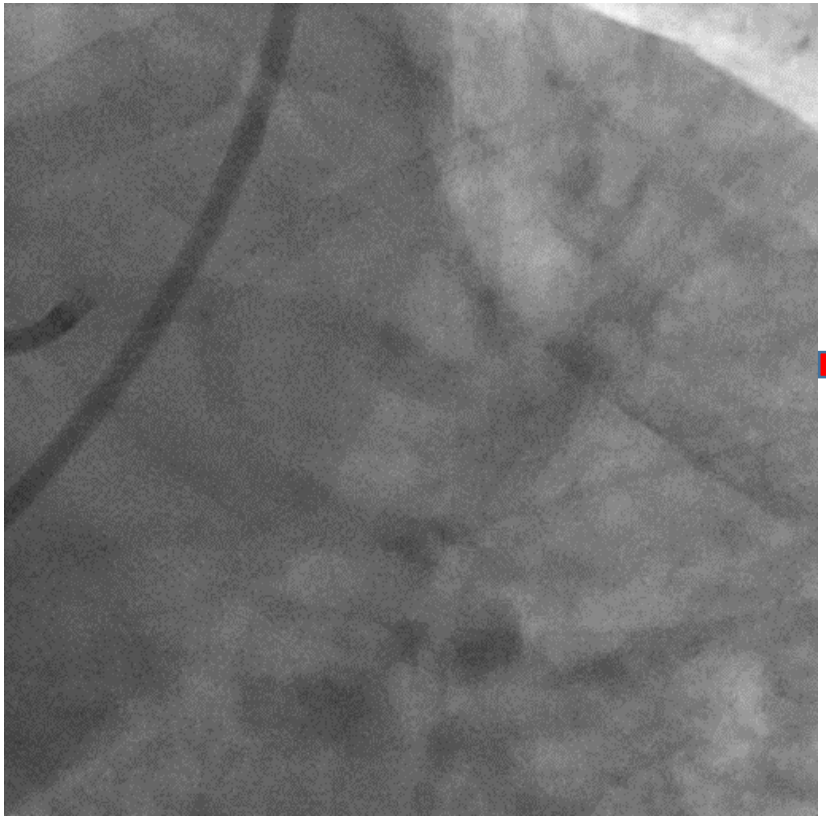


Then, Culotte stenting !!

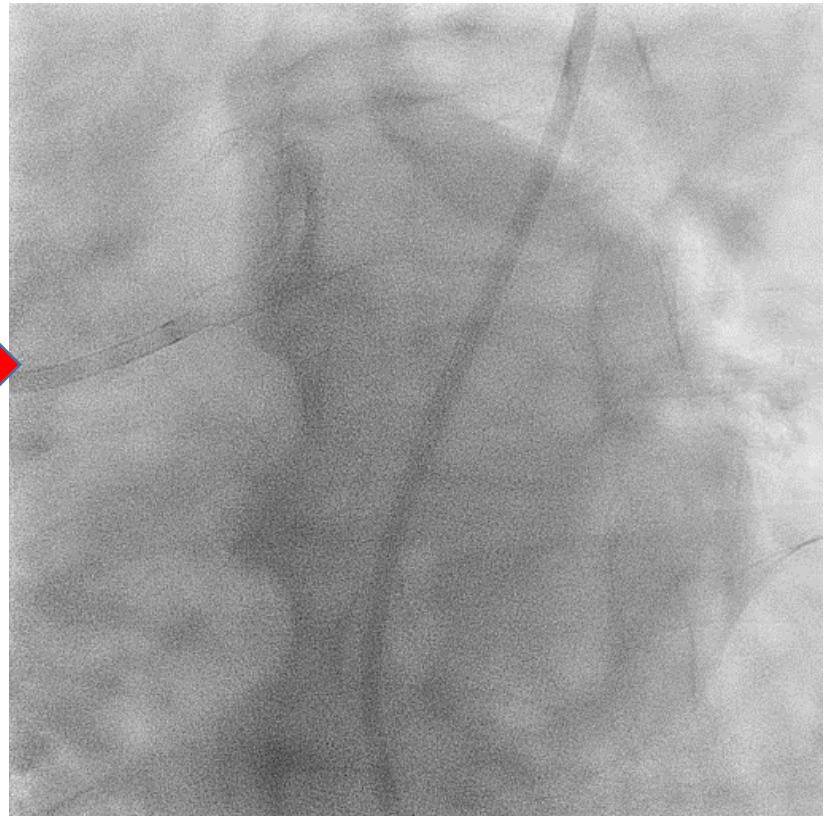


Case 4 : 80's Male, ; Severe ISR in LCX after Culotte Stenting in LMT

Final Angio 2012



Severe Restenosis 2018



Patient's Condition

① Clinical Presentation

Stable AP → Supporting device… No Need

② Location of ISR

LCX very diffuse ISR

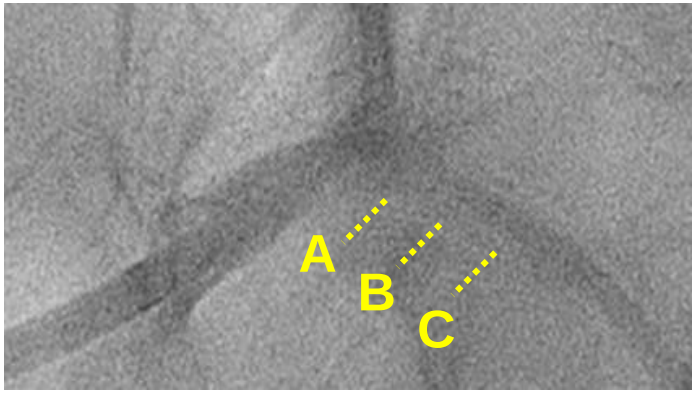
③ Evaluation : Characteristics of ISR

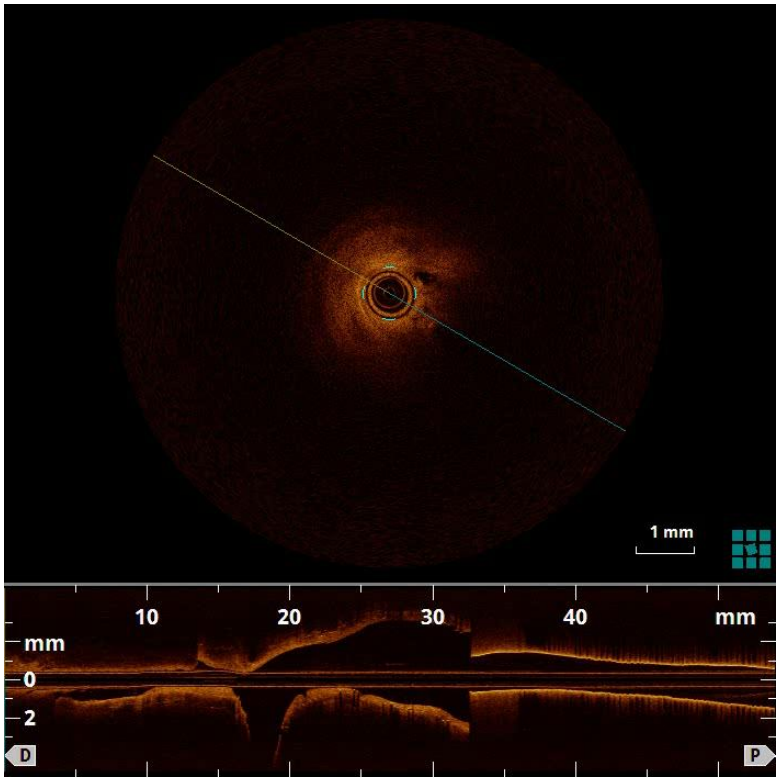
Diffuse, Long ISR and very Concentric → check OCT

④ Selection of Appropriate Device (for PCI)

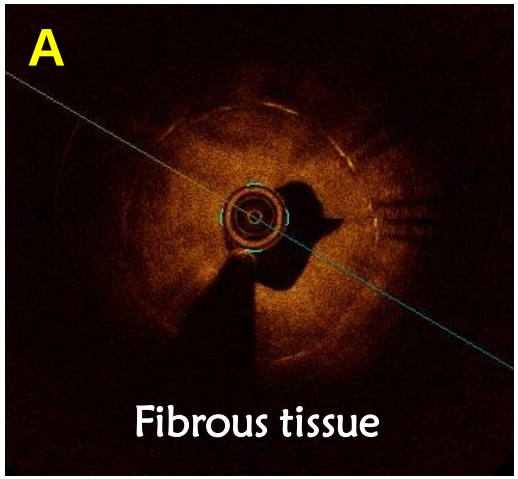
Imaging, debulking device(Rota) and DCB ??

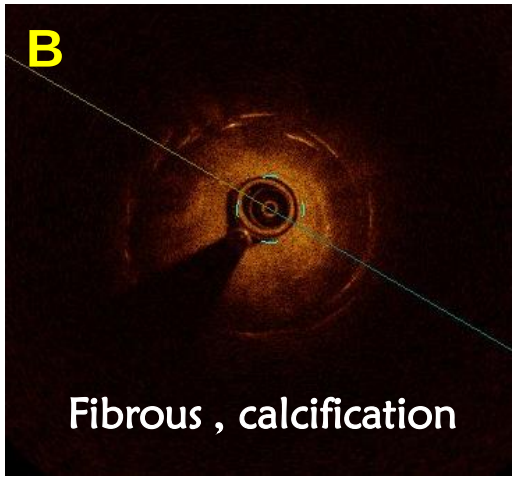
Pre OCT

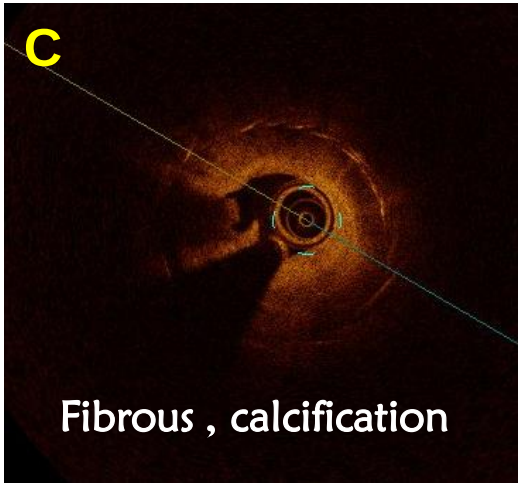




Location of tissue is very concentric !!







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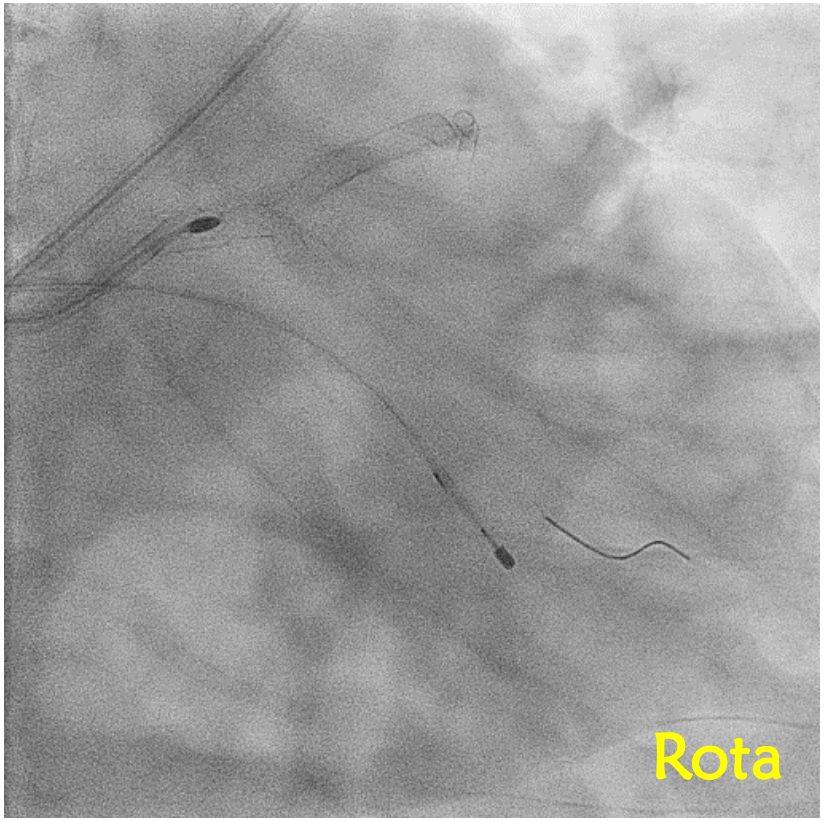
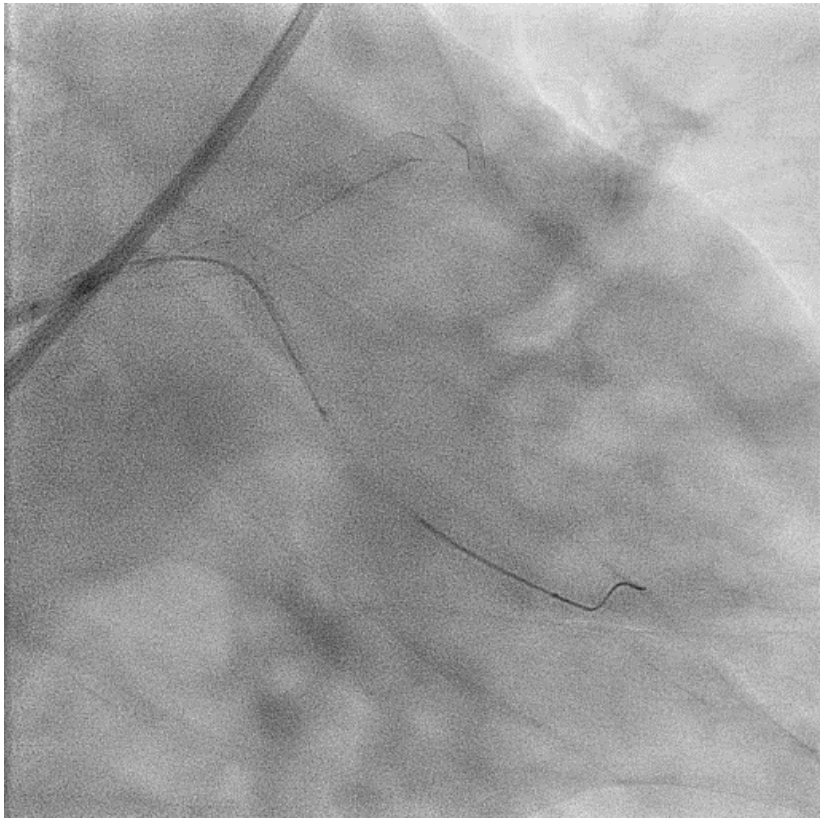
Rota 1.5~1.75mϕ and HP, DCB



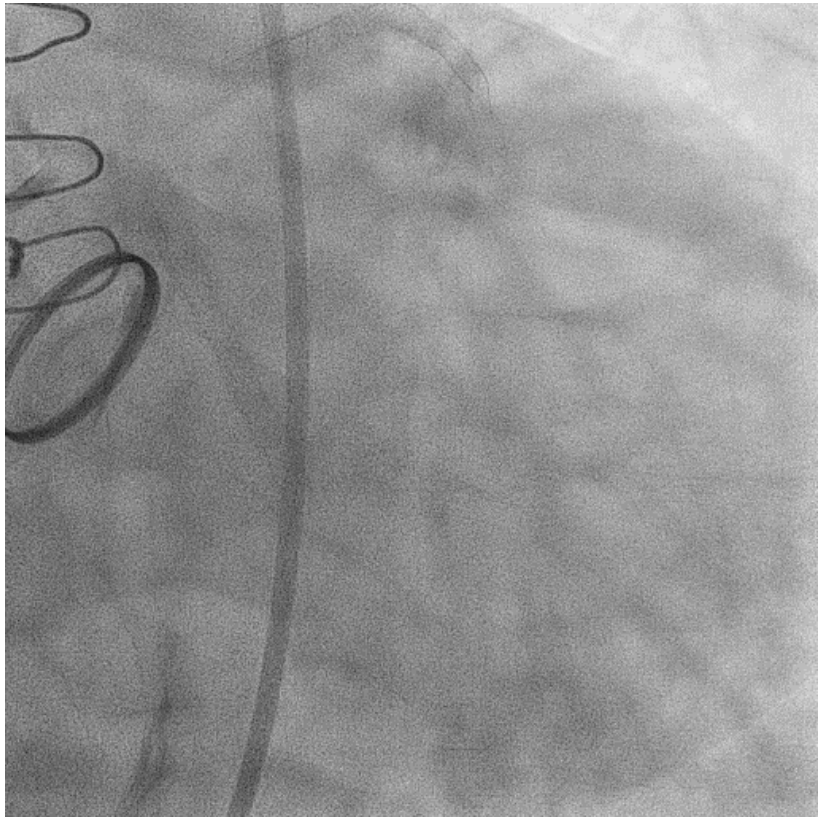
Final Angio.



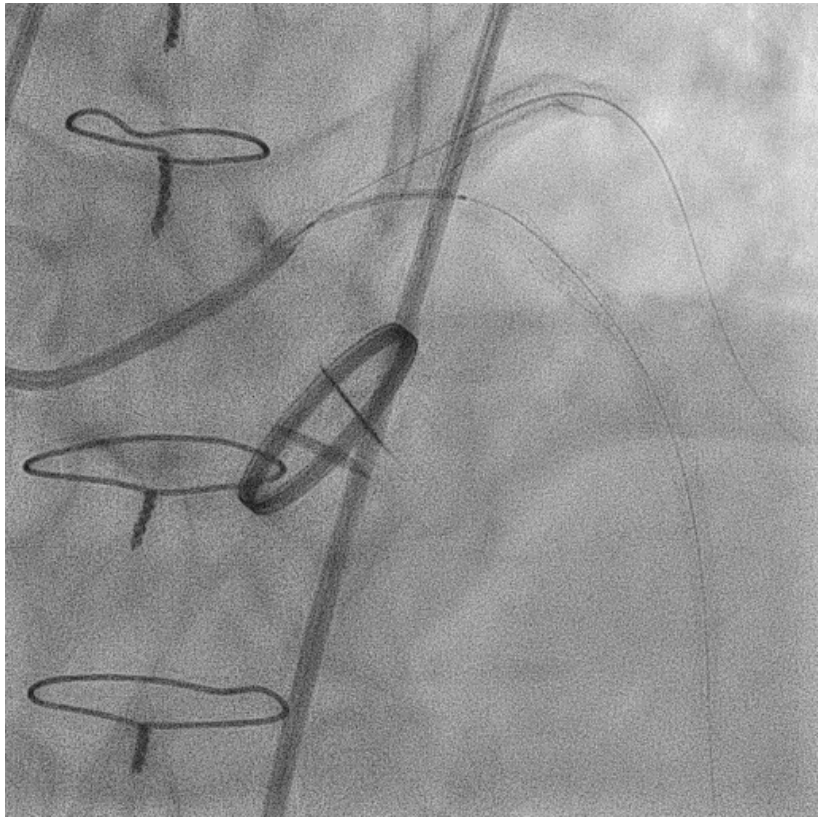
Case 5 : 80's Male, ; AHF due to Severe ISR in LMT~LAD,LCX

Baseline

SAP: LMT~LAD, stenosis



Stenting in LAD to LMT(100% cover)

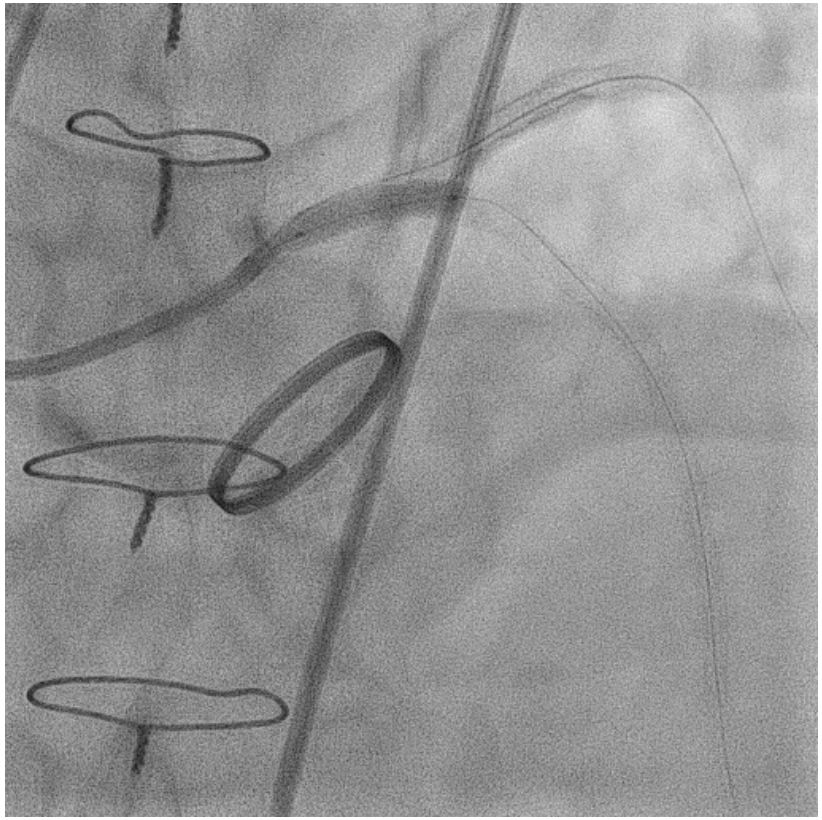


Baseline, may be we had better to choice another one !!

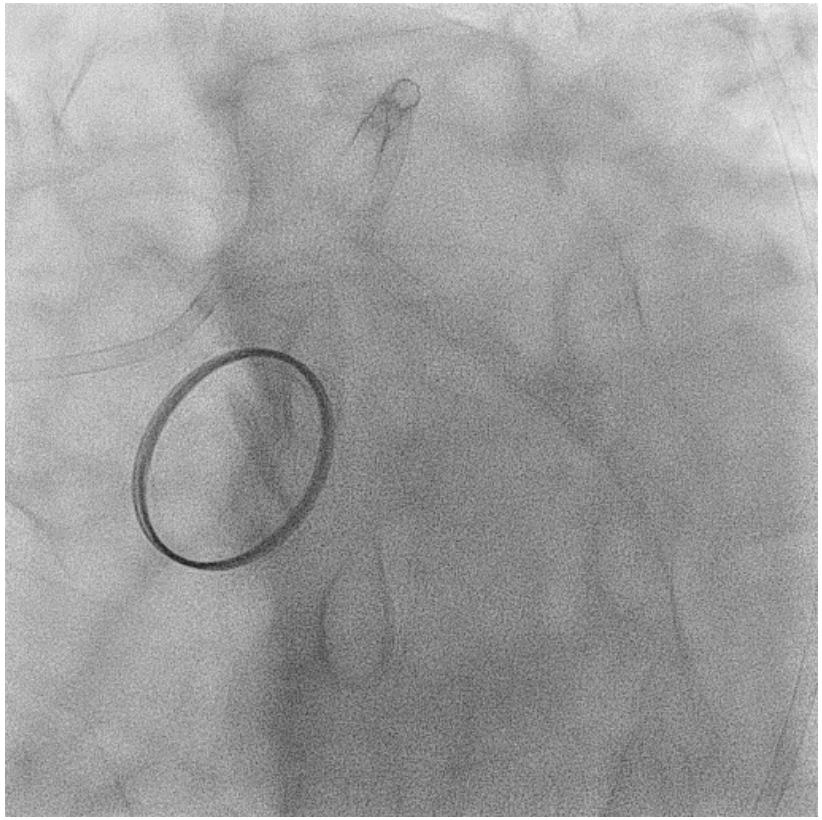
Case 5 : 80's Male, ; AHF due to Severe ISR in LMT~LAD,LCX

Baseline; basically already DES in LCX lomg…

Stenting with POT, Optimize…



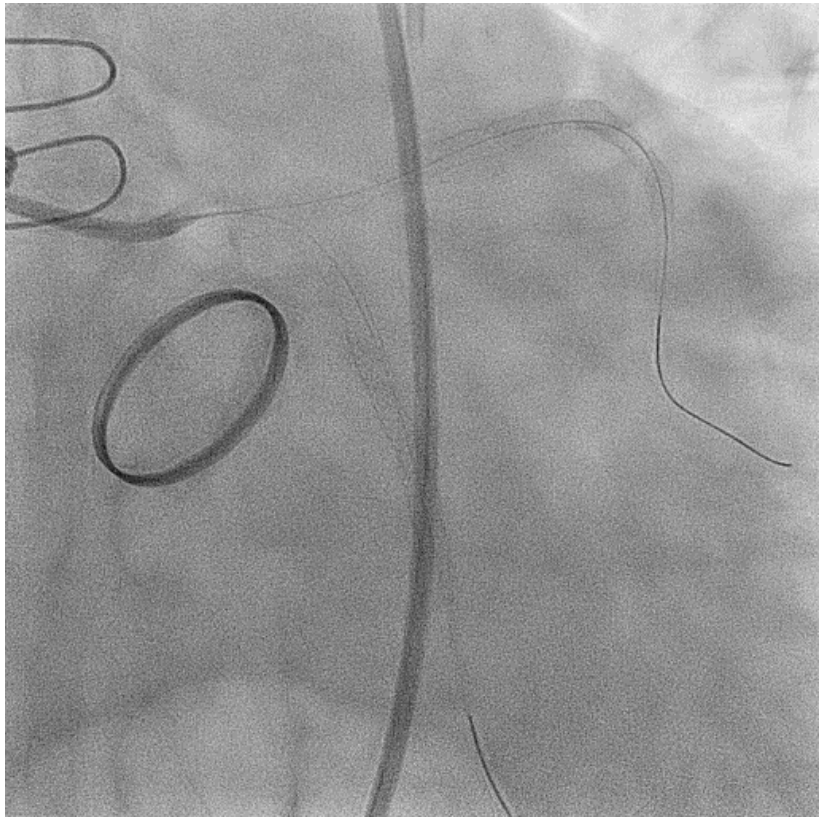
Final Angio



Baseline, may be we had better to choice another one !!

Case 5 : 80's Male, ; AHF due to Severe ISR in LMT~LAD,LCX

Acute Heart Failure due to severe restenosis in LMT bifur. Just after 9 month.

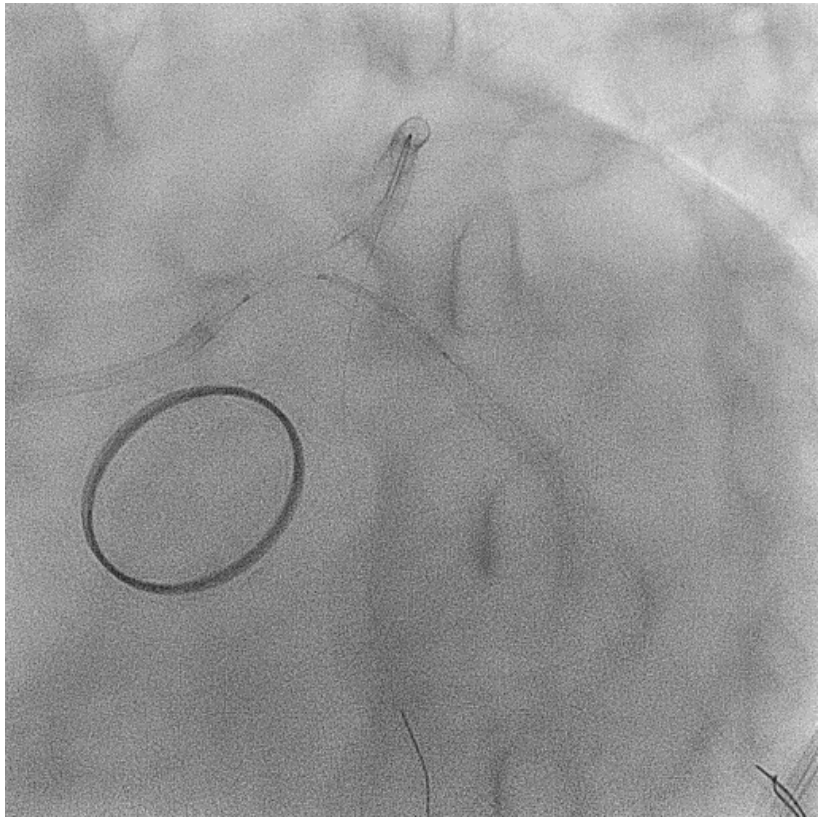


1. Just.. 9M Later, After stenting in LMT…
2. AHF due to Severe ISR in LMT
3. No Stent in LCX ost.
4. Need IABP : 2016 before IMPELLA

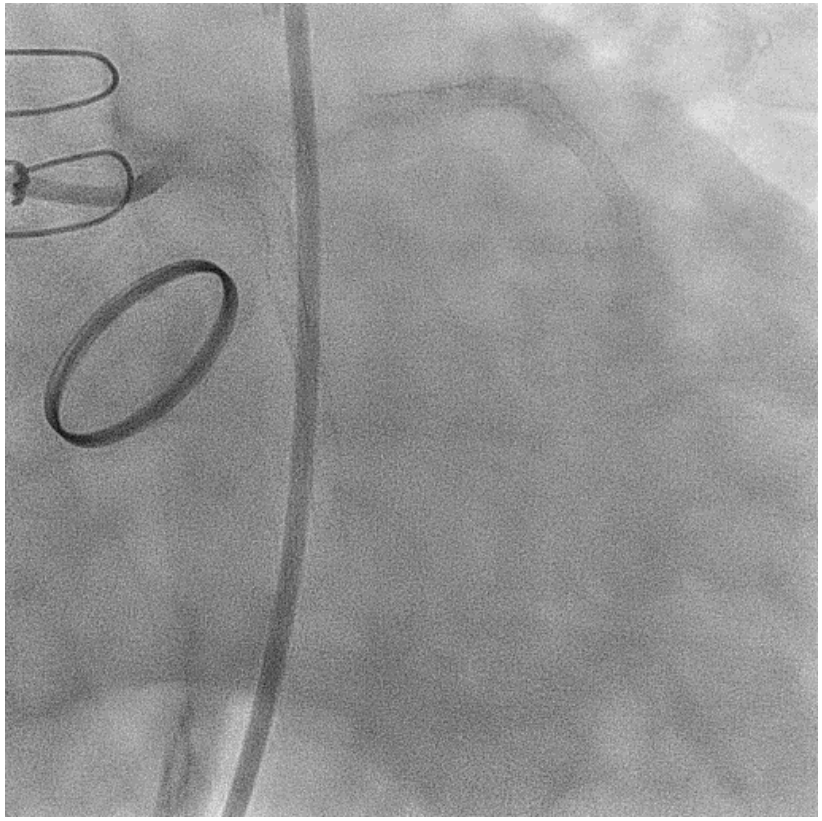
Case 5 : 80's Male, ; AHF due to Severe ISR in LMT~LAD,LCX

2nd Baseline

Stenting in LCX just Prox.

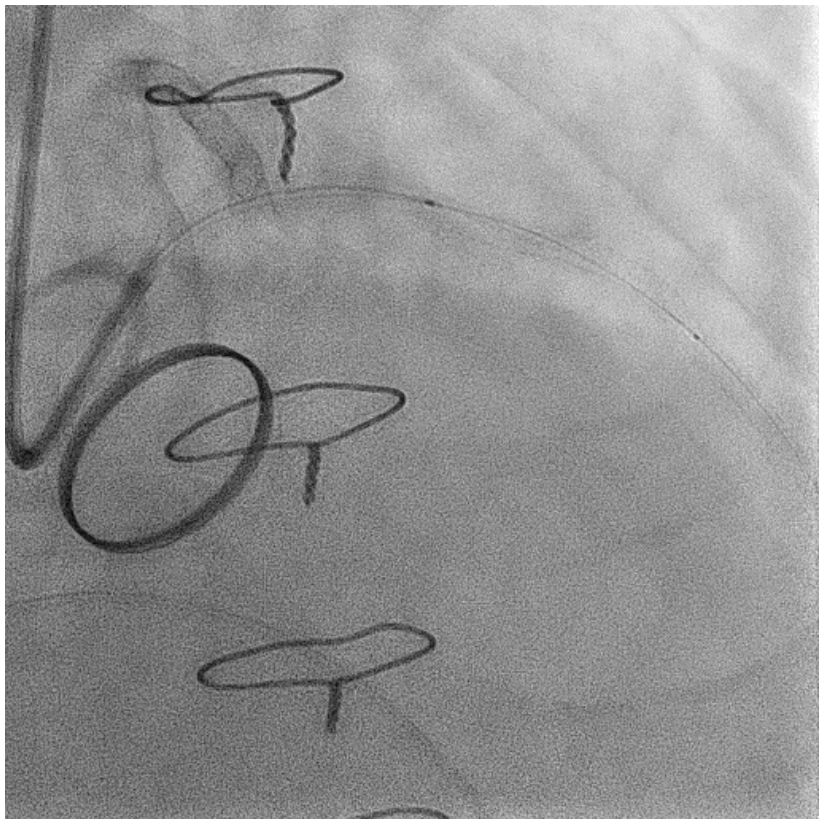


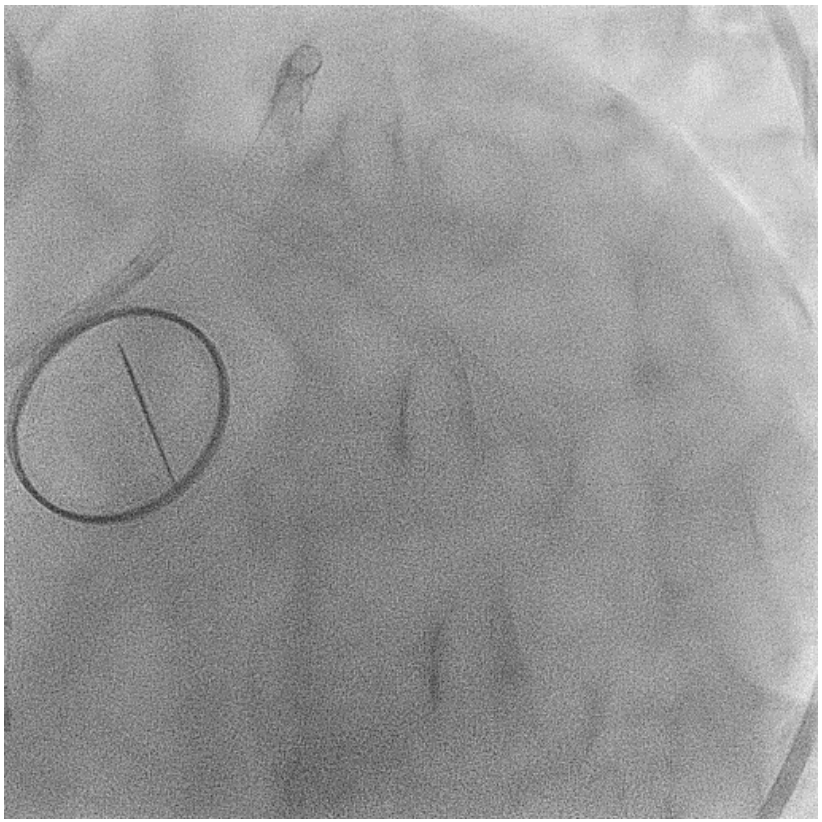
Stenting in LCX just Prox. 1 year later



Case 5 : 80's Male, ; AHF due to Severe ISR in LMT~LAD,LCX

2nd Acute Heart Failure !! after LMT stenting due to **RE-RESTENOSIS** in LMT bifur.





This is not good !!"2nd Acute Heart Failure" due to second restenosis after LMT stenting due to severe restenosis in LMT bifur.area → Increasing Mortality !!..... No Good !!

Patient's Condition

① Clinical Presentation

U-AP → Supporting device… IABP (just before impella)

② Location of ISR

LMT bifurcated area : severe diffuse !!

③ Evaluation : Characteristics of ISR

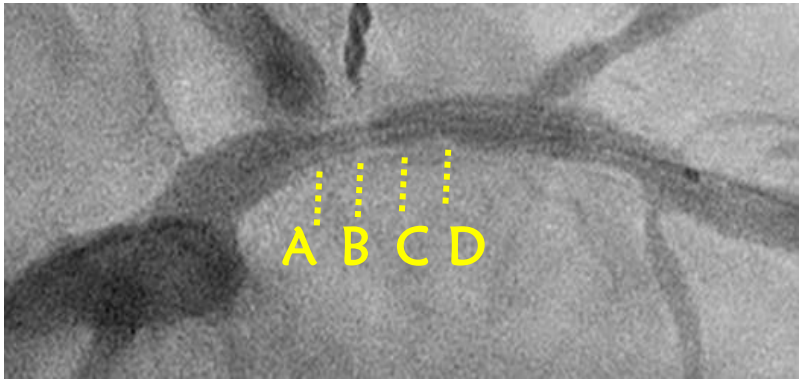
Diffuse, Long ISR and very Concentric in both vessel

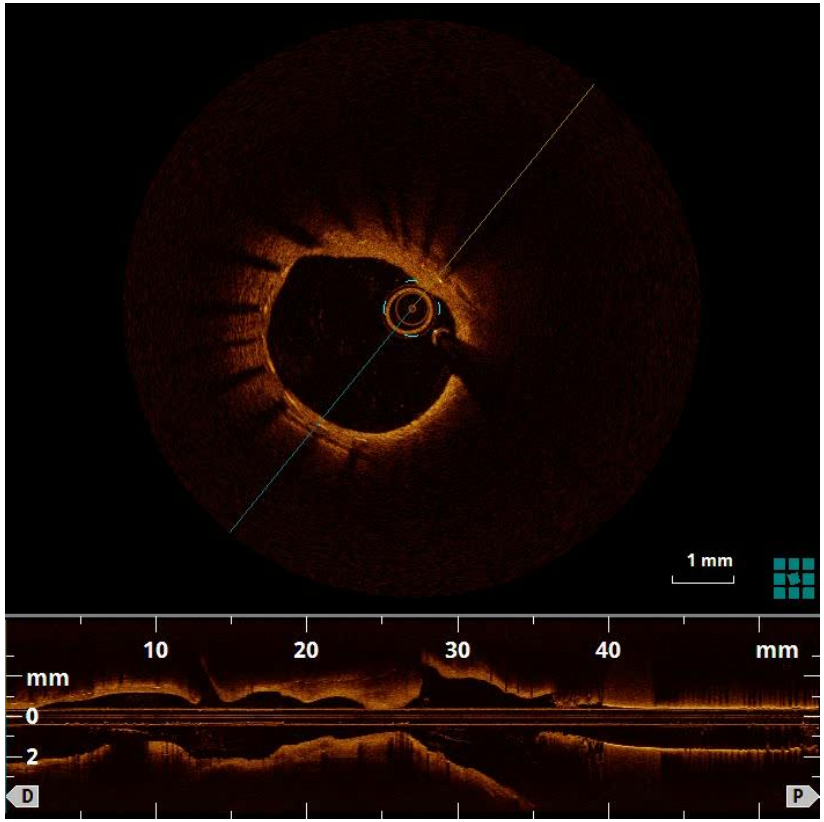
④ Selection of Appropriate Device (for PCI)

Skillful operator who can finalize this very difficult condition

Need Quickness !!

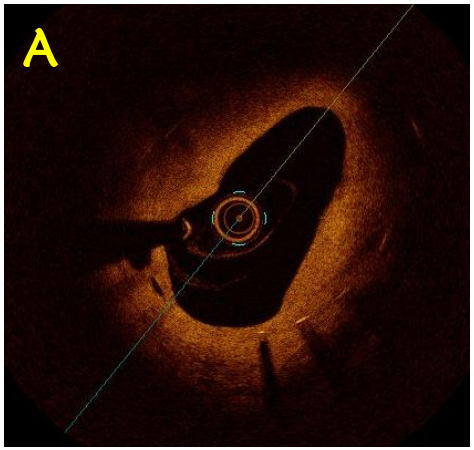
Pre OCT

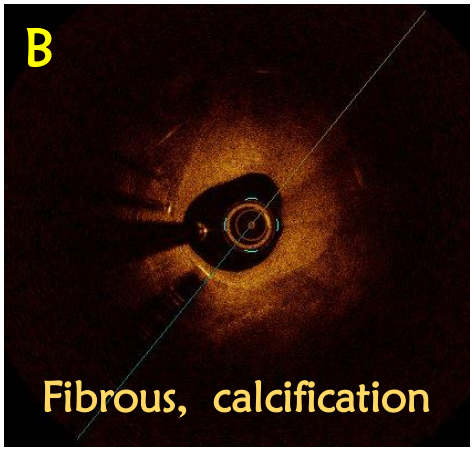


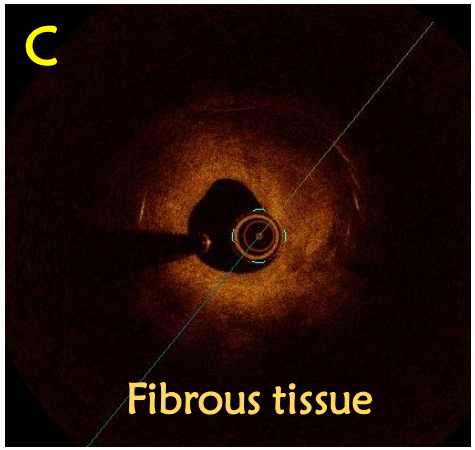


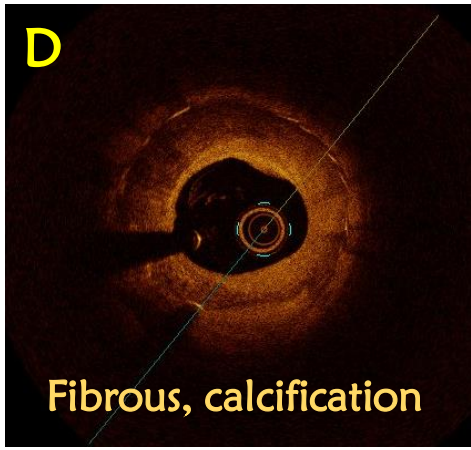
Location of tissue is very concentric !!

In both vessel…



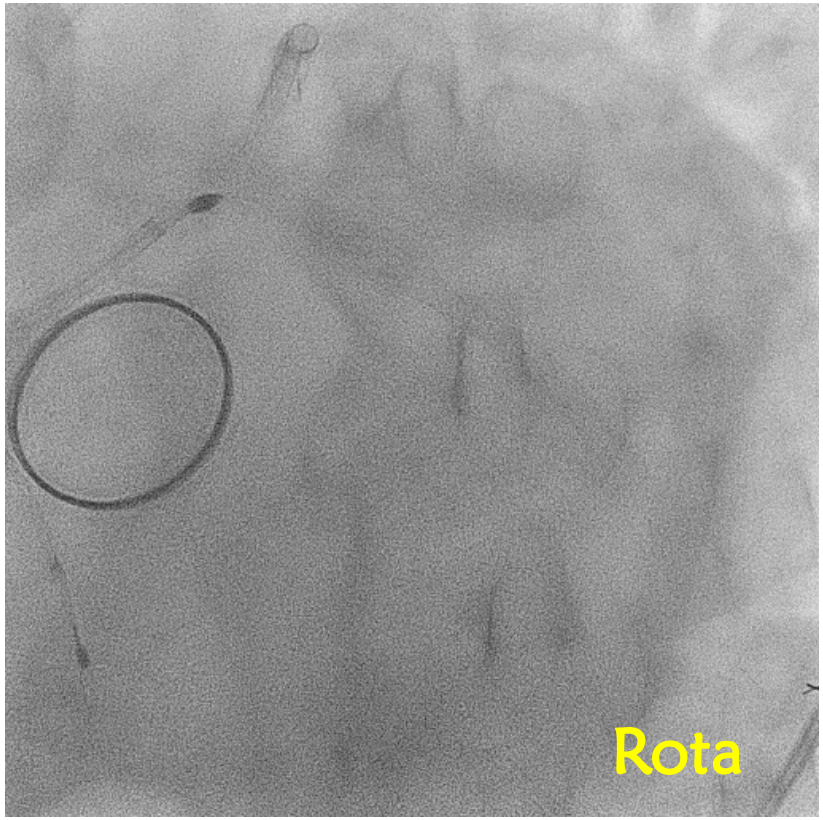


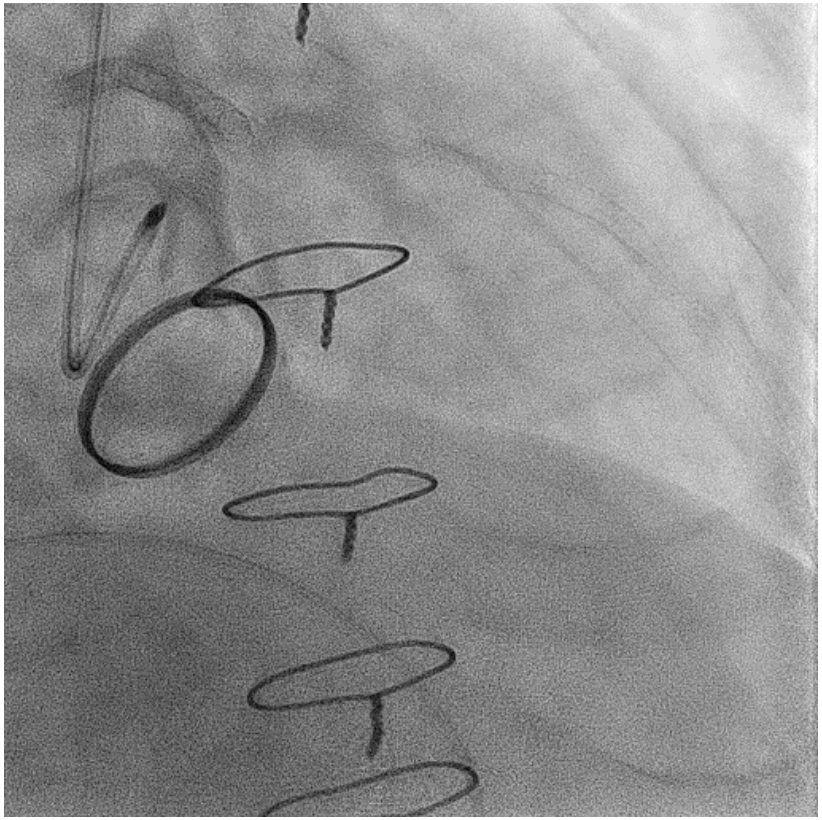




Case 5 : 80's Male, ; AHF due to Severe ISR in LMT~LAD,LCX

Rota 1.5, 1.75mmϕ debulking , 3.0mm HP and DCB



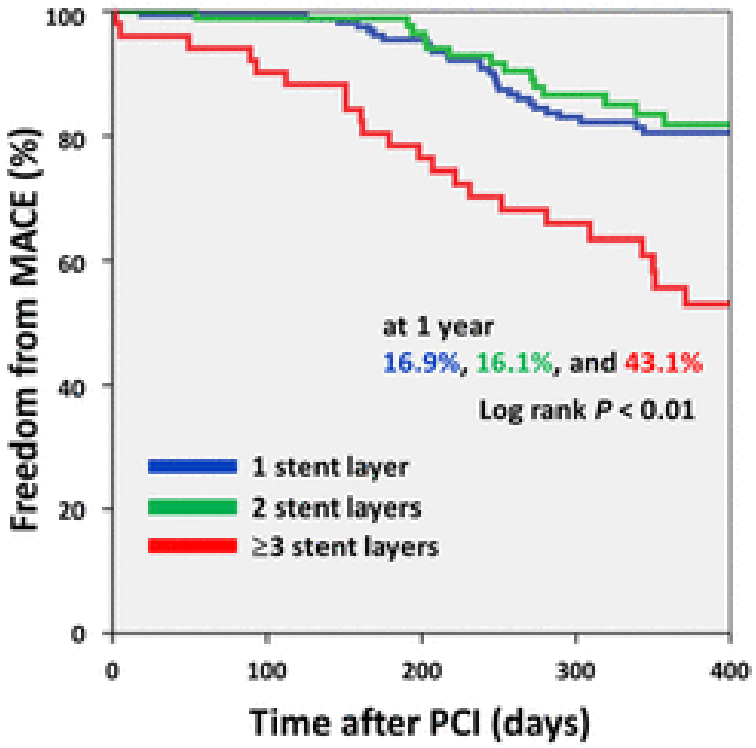


④ Multiple stents make DCB less effective

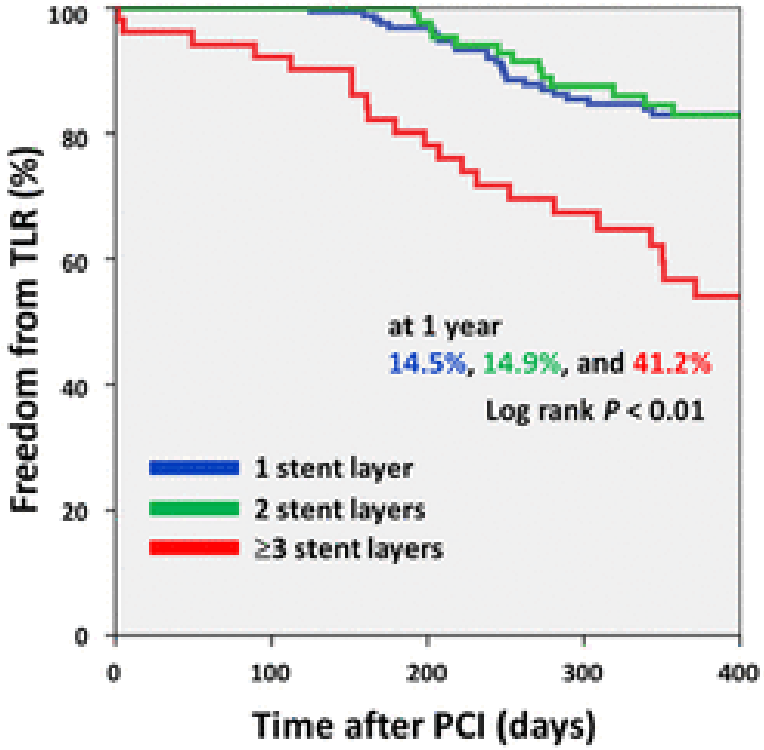
Clinical Outcomes of Drug-Eluting Balloon for In-Stent Restenosis Based on the Number of Metallic Layers

n=304

Mace



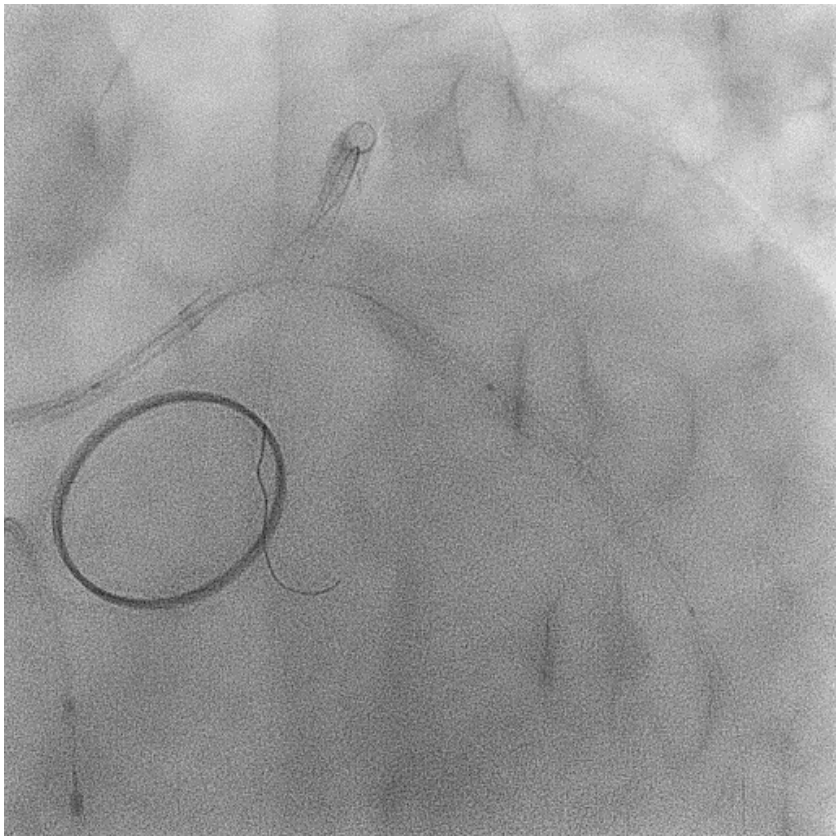
TLR

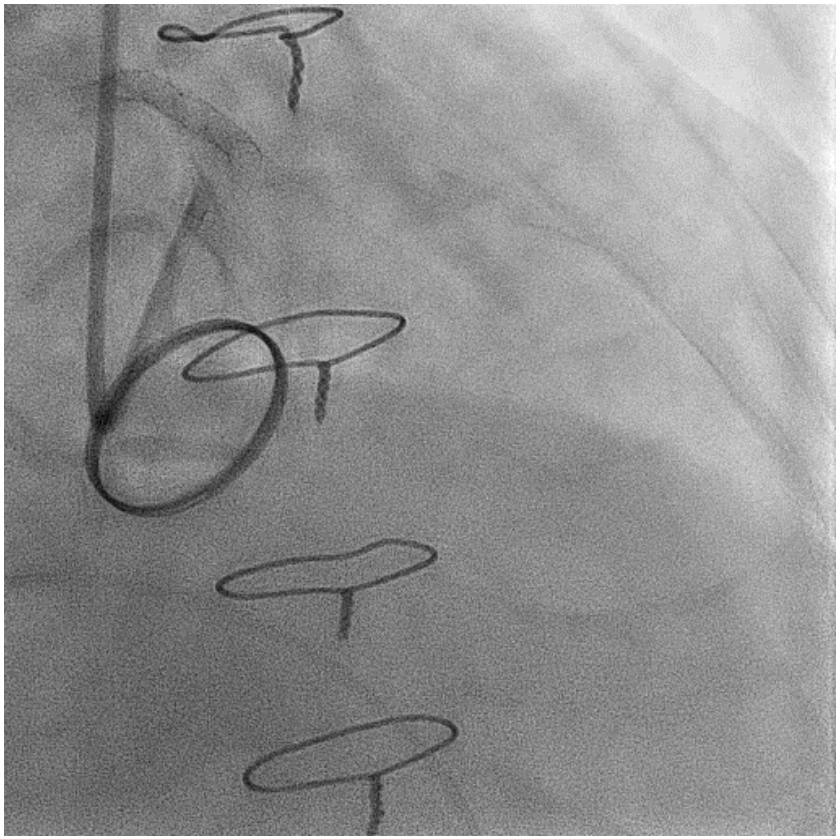


Yabushita H, Nakamura S, et al. Circulation: Cardiovascular Interventions 2018

Case 5 : 80's Male, ; AHF due to Severe ISR in LMT~LAD,LCX

Final Angio , went to CCU: control HF with IABP support

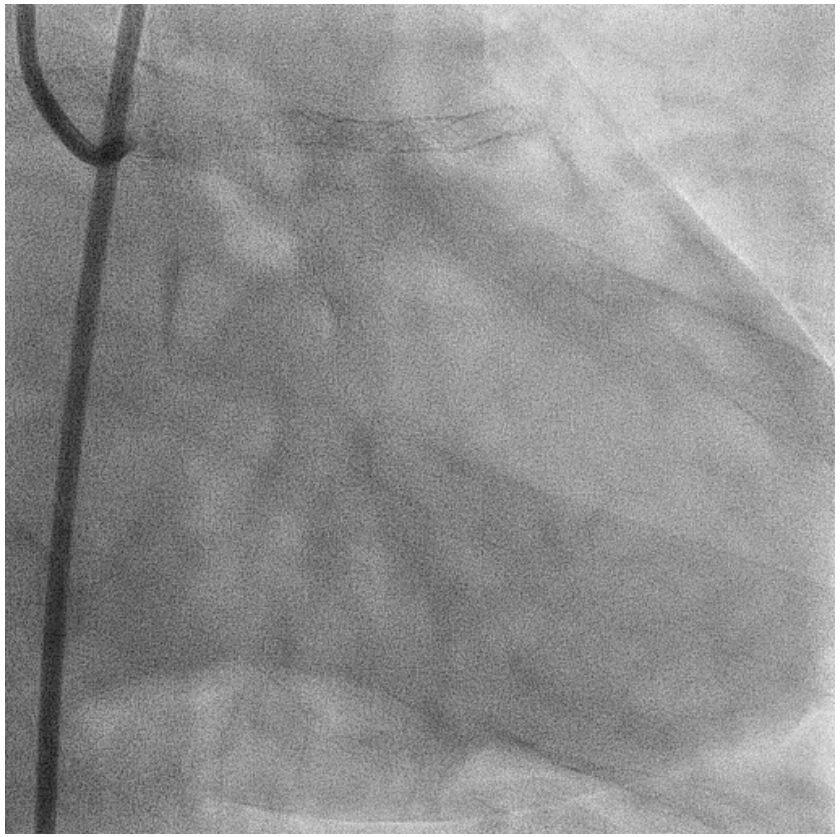




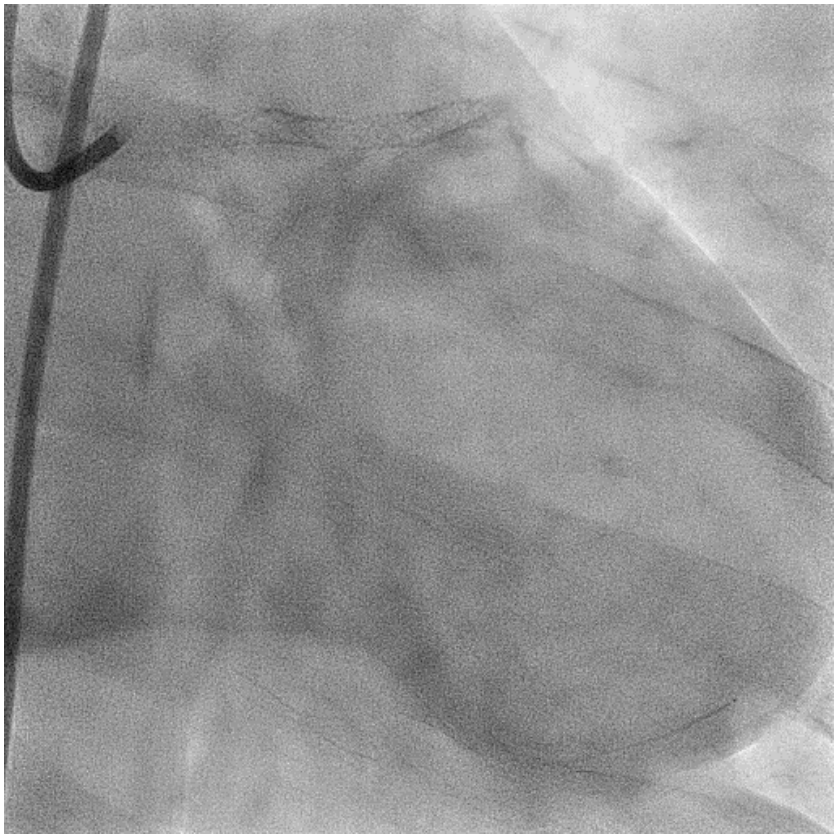
Case 6 : 80's Male, ; UAP due to Severe ISR in LCX

Baseline: Stenting in LMT 2010 and ….

2018 checking angio. (clinical study) OK !!

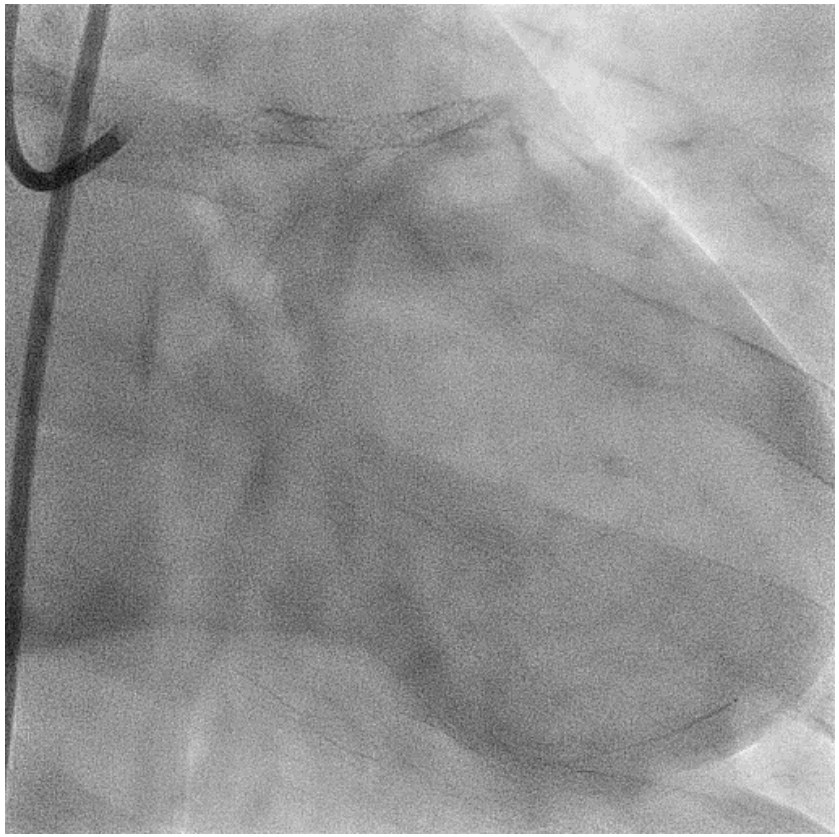


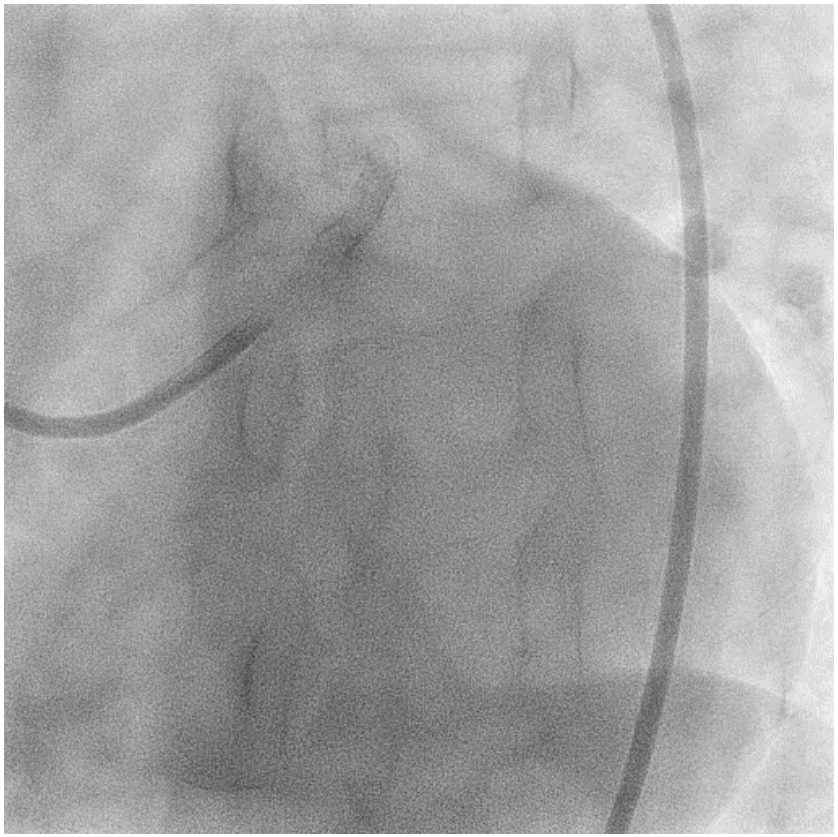
2020 severe diffuse stenosis in LCX ???



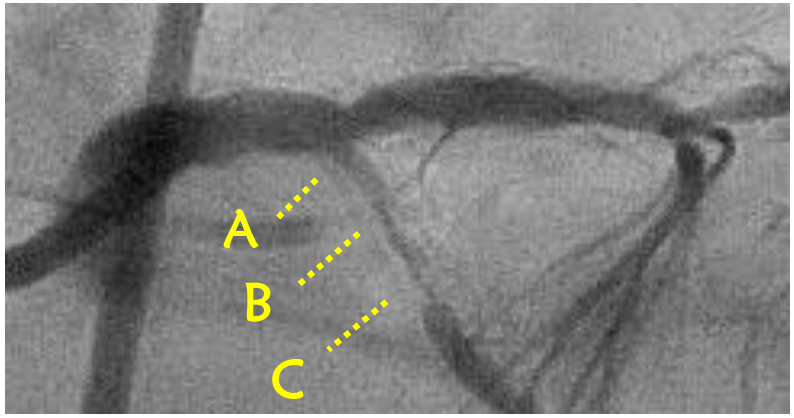
Case 6 : 80's Male, ; UAP due to Severe ISR in LCX

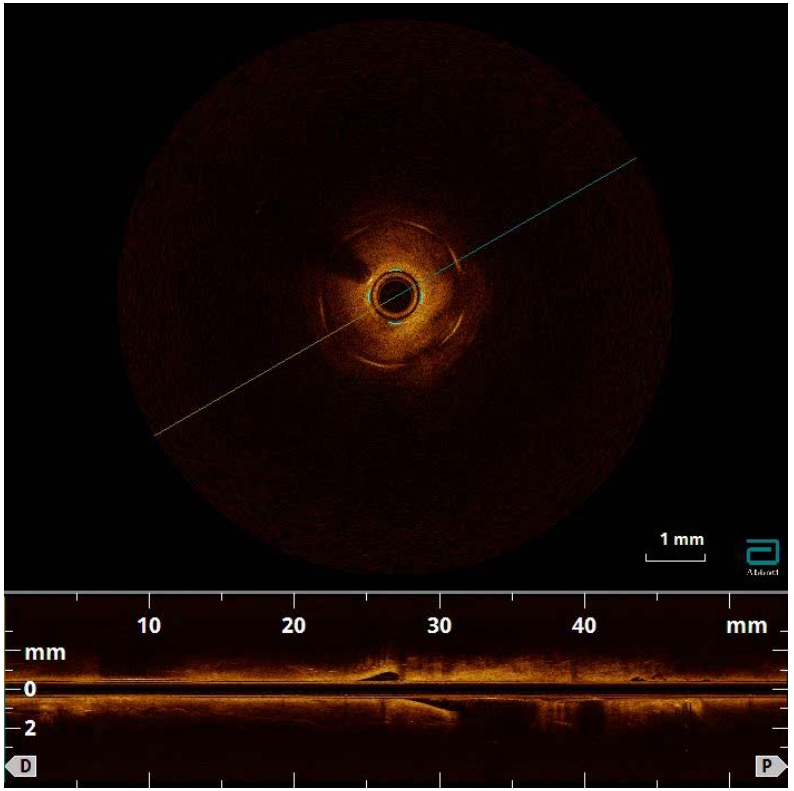
Diffuse ISR severe ISR in LCX and Focal stenosis in LAD: 12 years later…





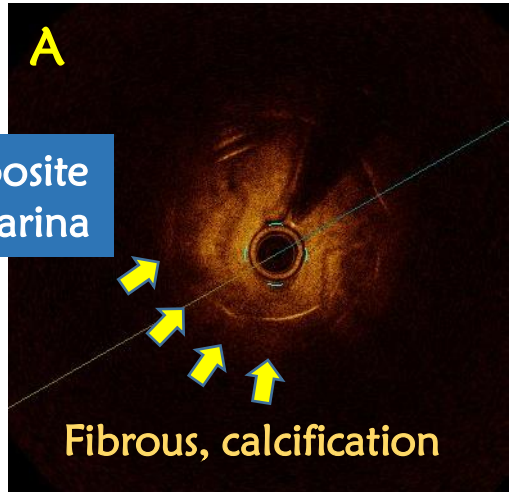
Pre OCT



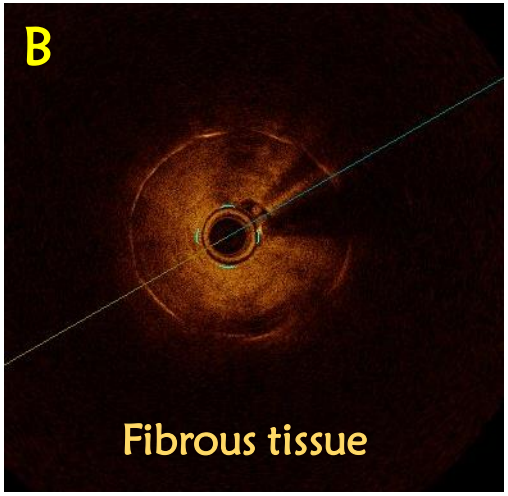


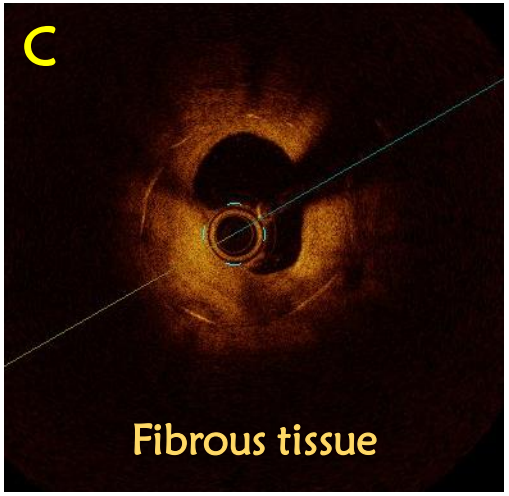
Location of tissue is very concentric !!

And very thick in opposite to CARINA



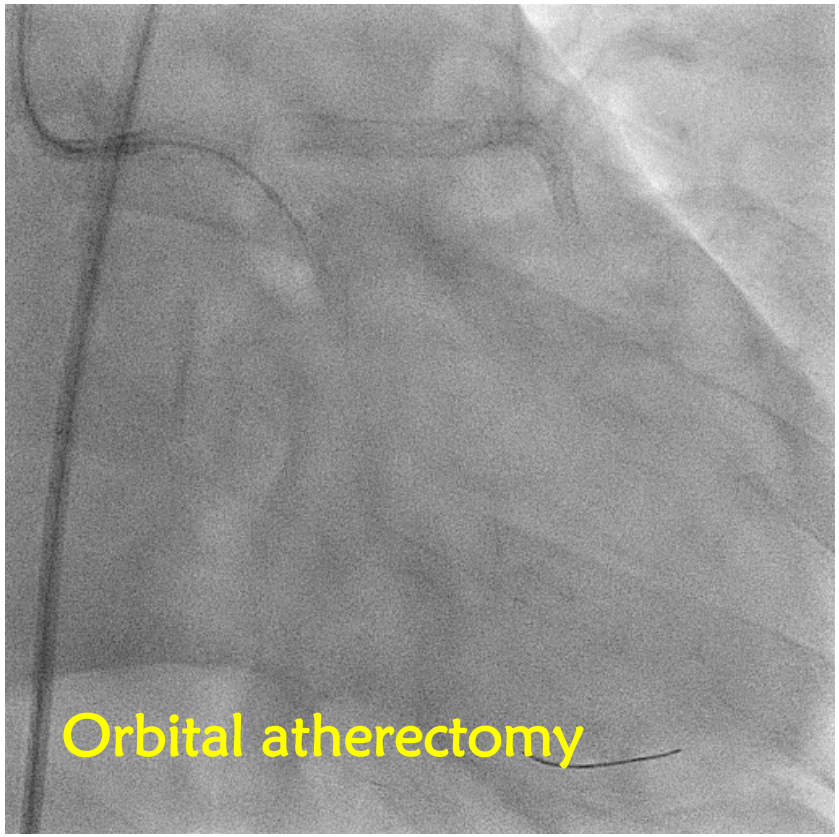
Opposite to Carina

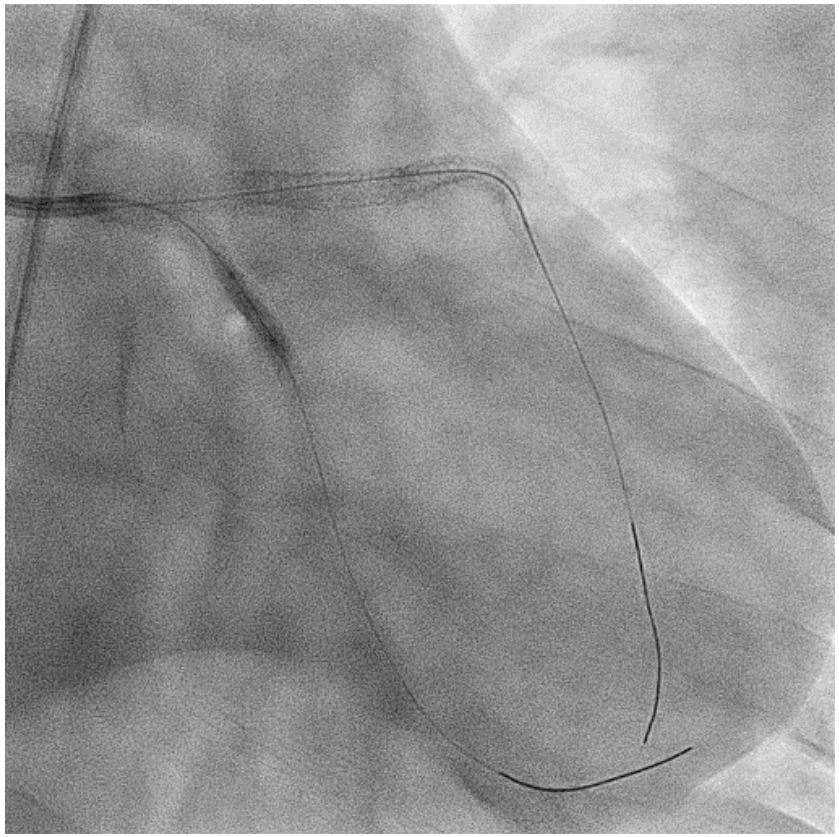




Case 6 : 80's Male, ; UAP due to Severe ISR in LCX

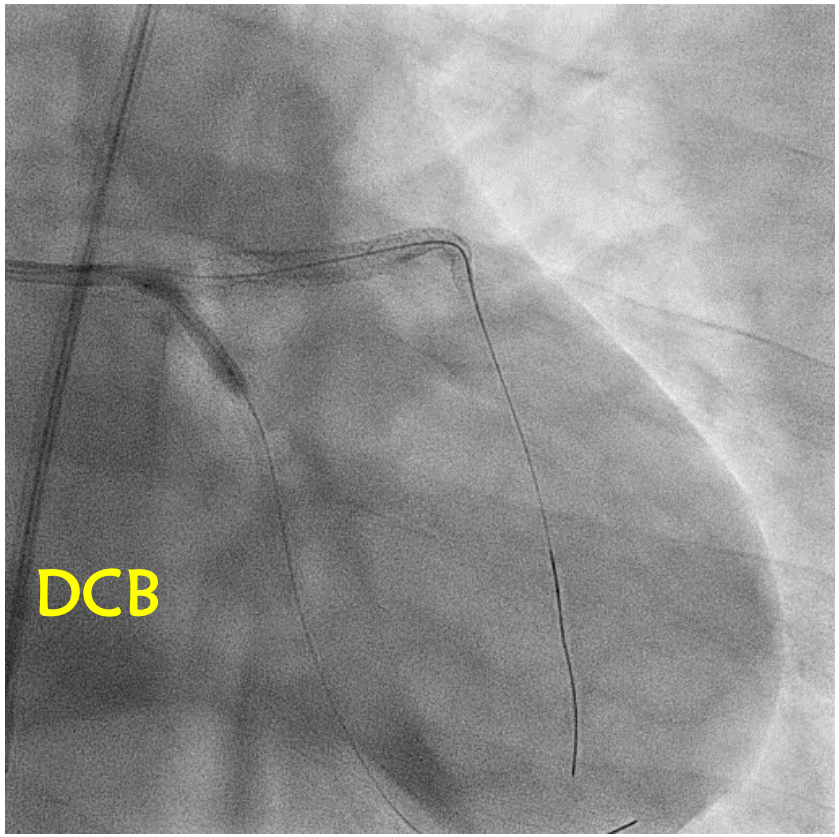
Select OAS because of fibro calcified plaque mainly located in opposite to carina site



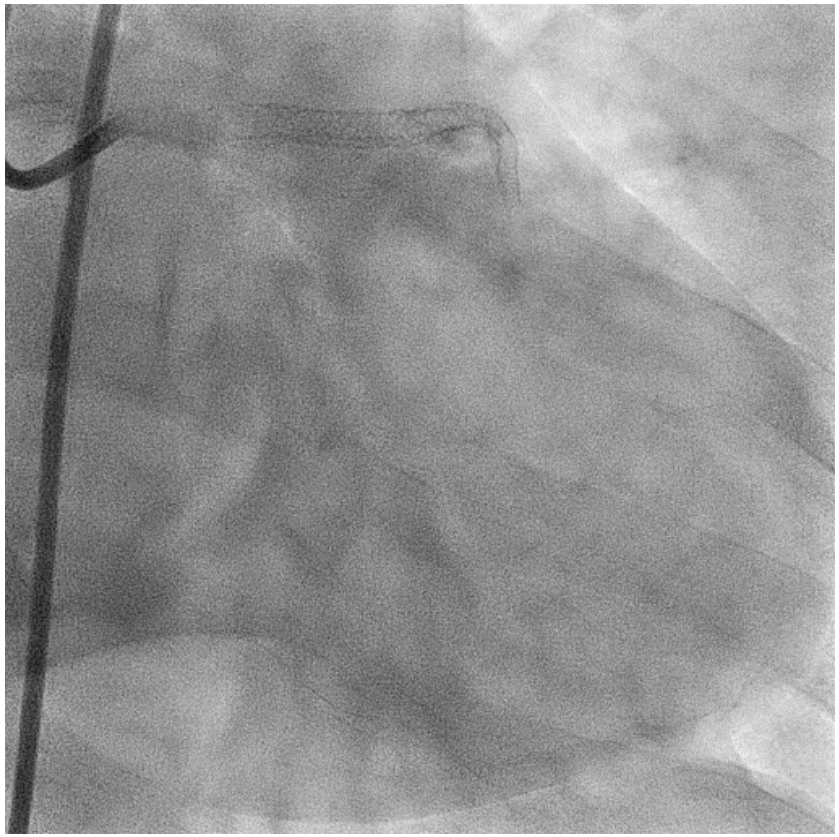


Case 6 : 80's Male, ; UAP due to Severe ISR in LCX

DCB

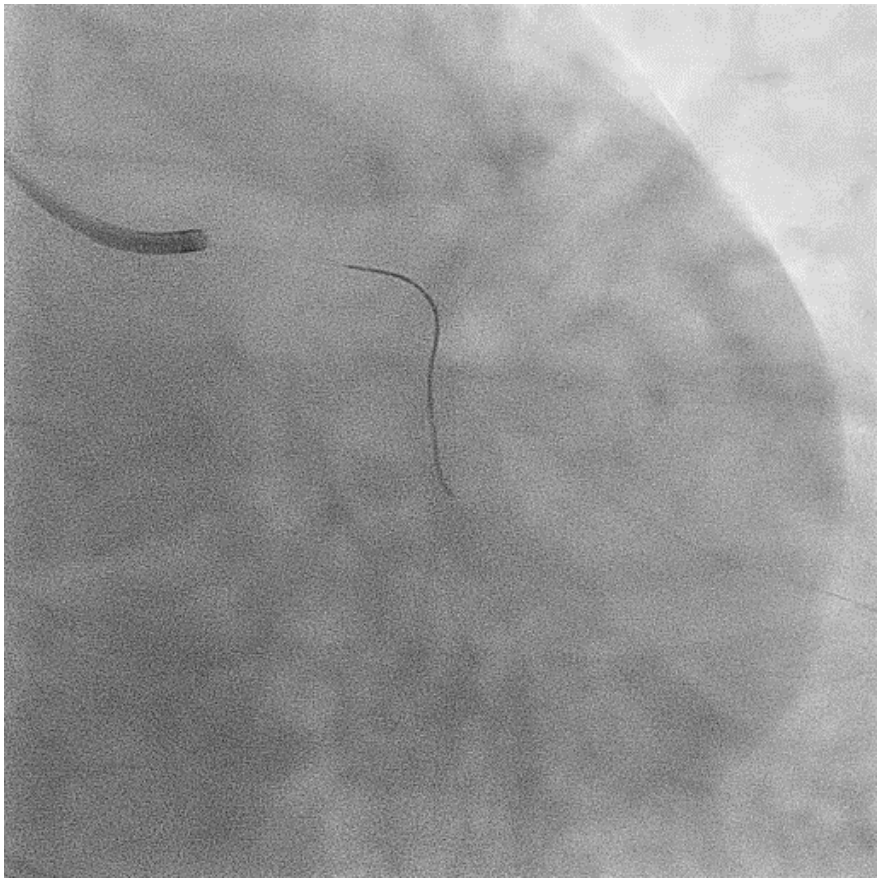


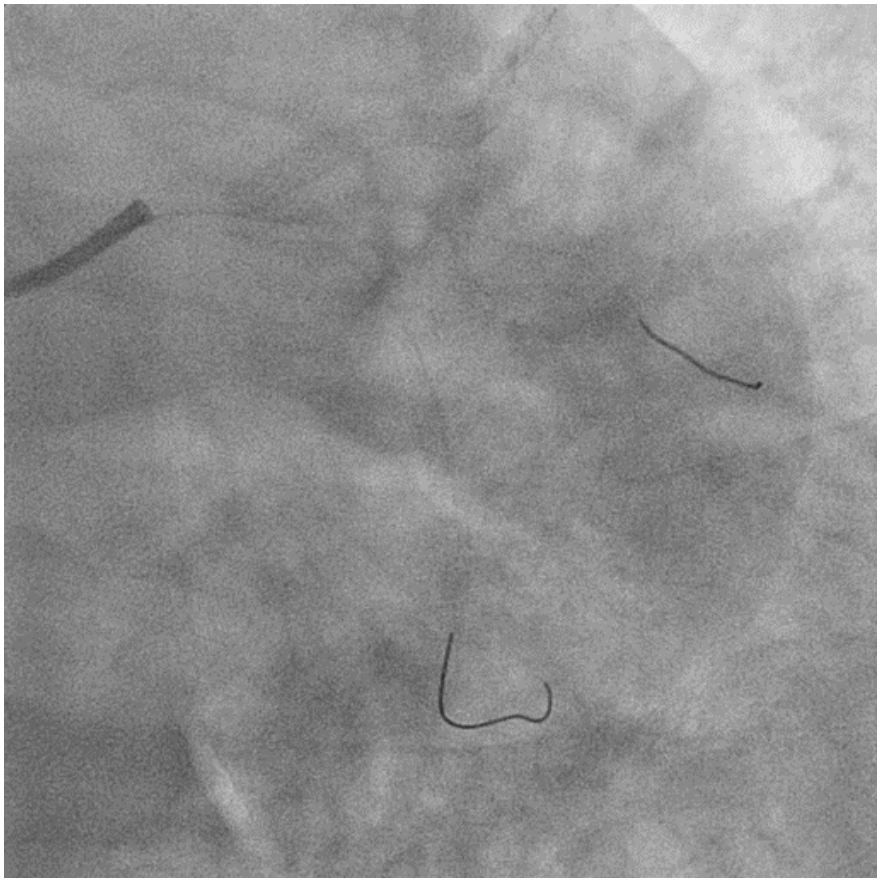
Final Angio.



Case 7 : 70's male: SAP due to Restenosis after V-Stenting in LMT

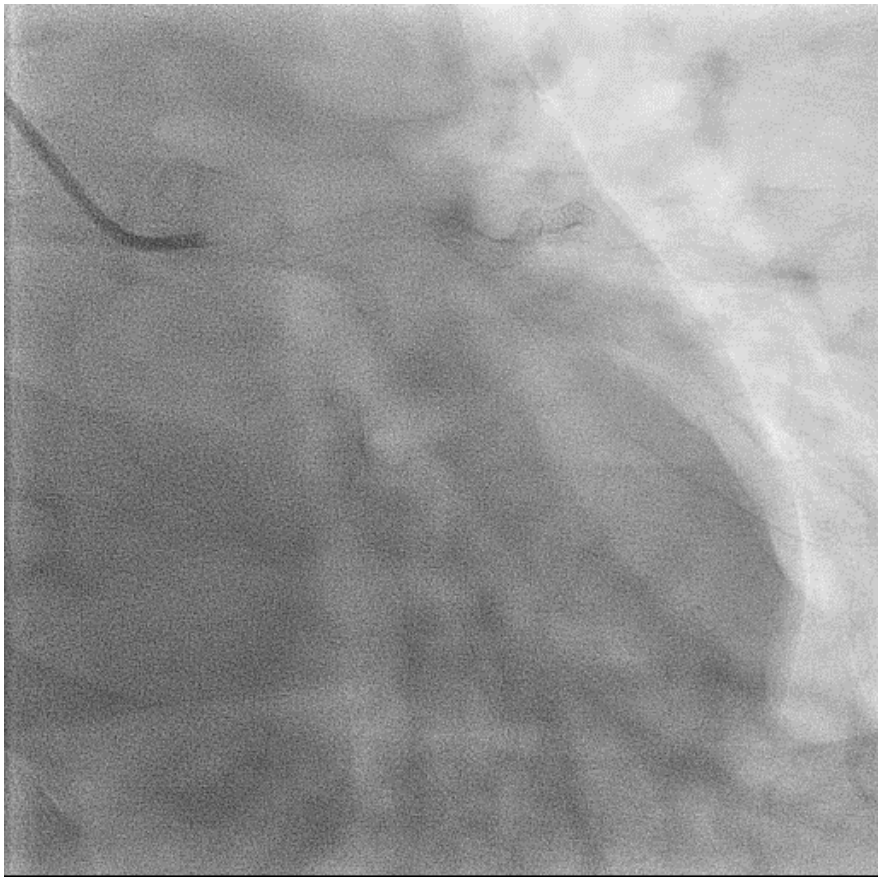
V-stenting in LAD ost.~mid. and LCX ost.~mid in 2010

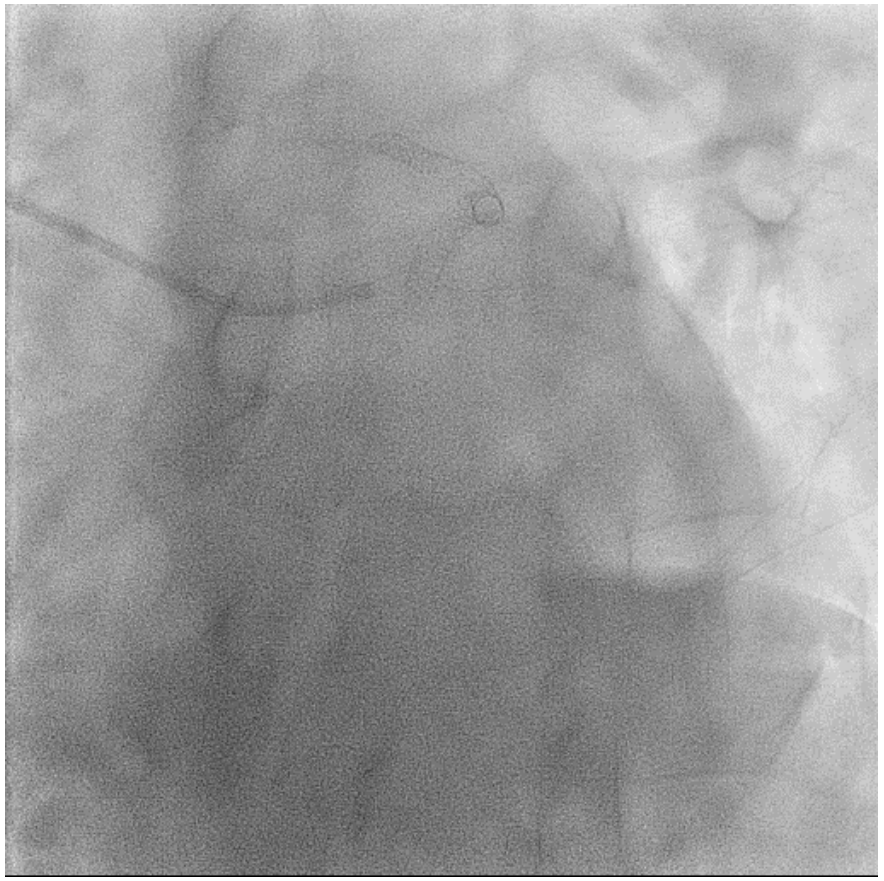




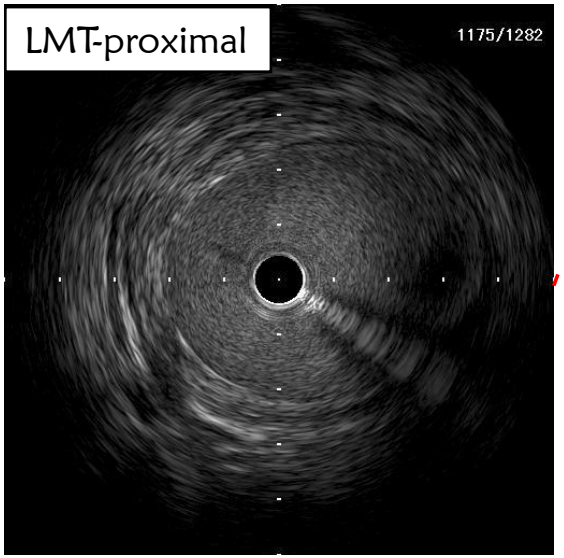
Case 7 : 70's male: SAP due to Restenosis after V-Stenting in LMT

Stenosis in LMT distal just before area of V-stenting in LAD and LCX

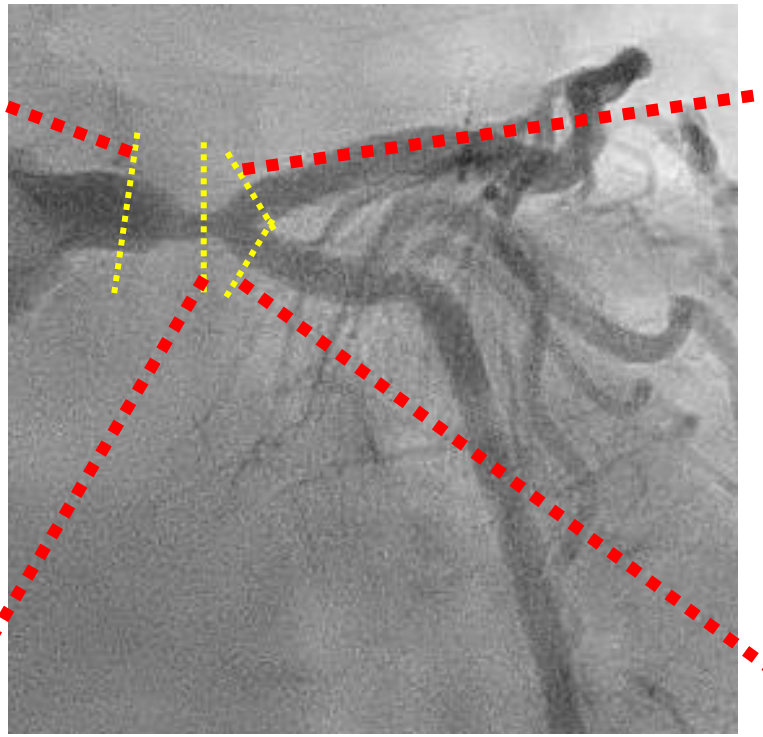


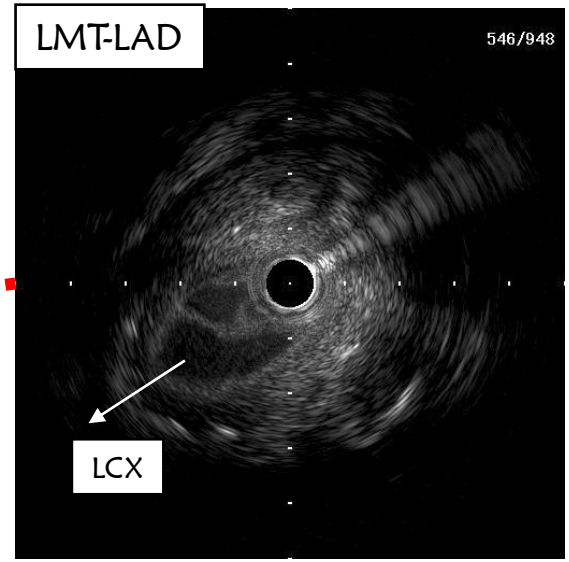


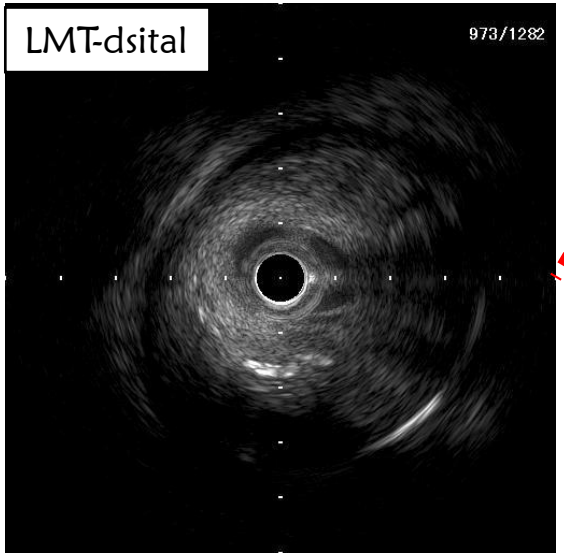
Case 7 : 70's male: SAP due to Restenosis after V-Stenting in LMT

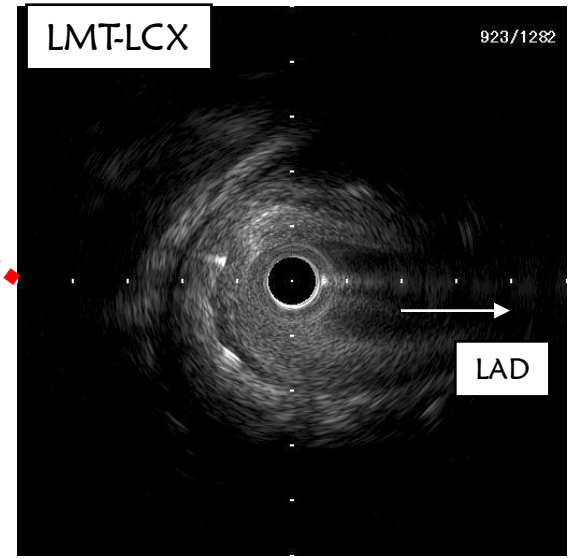


IVUS: Big Plaque burden
w/o obvious calcium

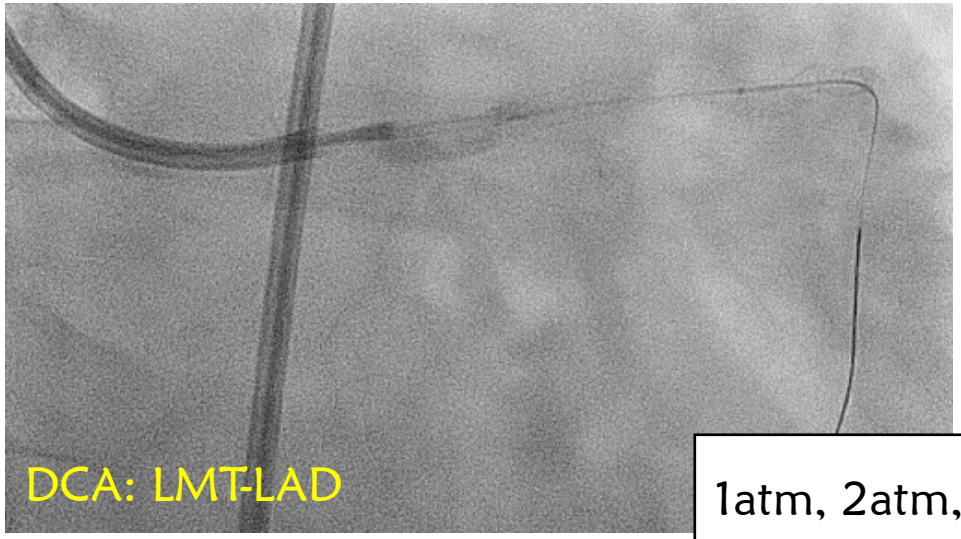


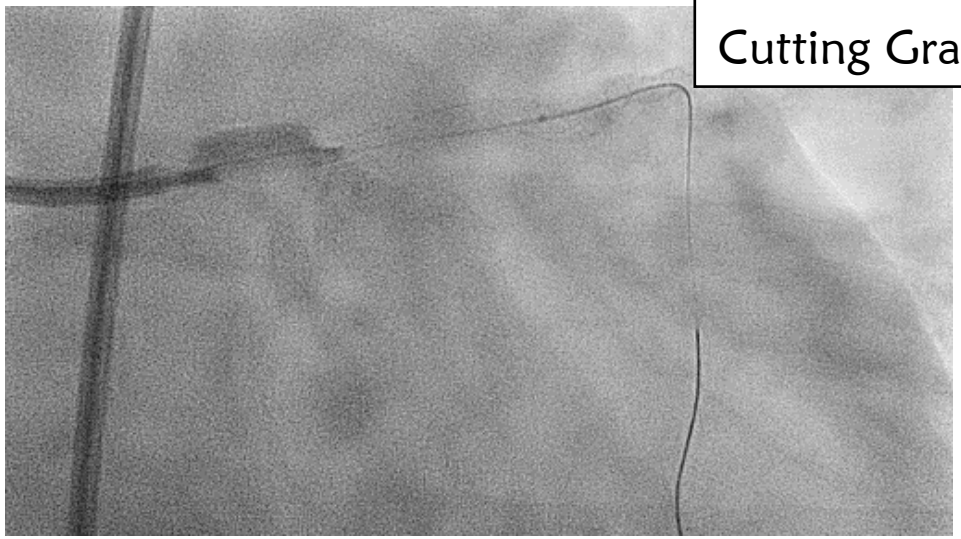






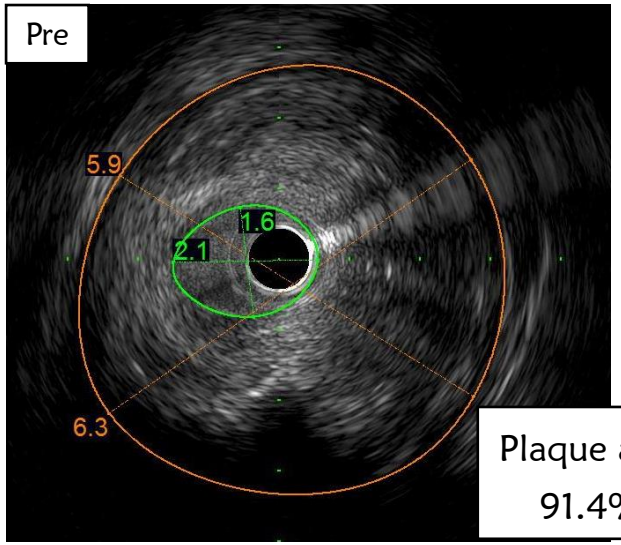
Case 7 : 70's male: SAP due to Restenosis after V-Stenting in LMT

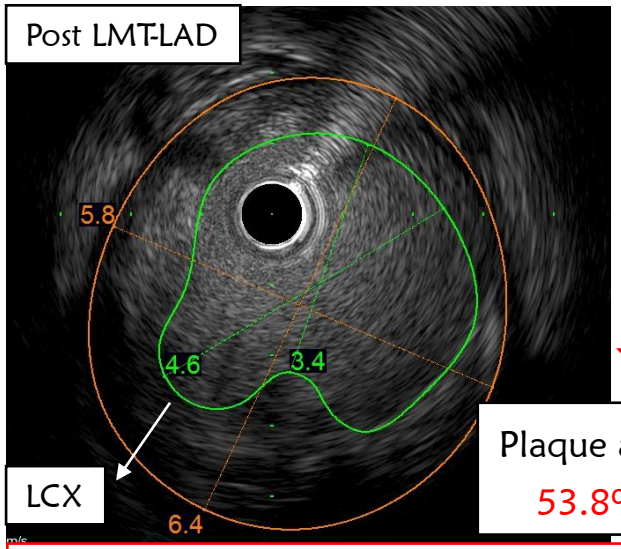




1atm, 2atm,3atm

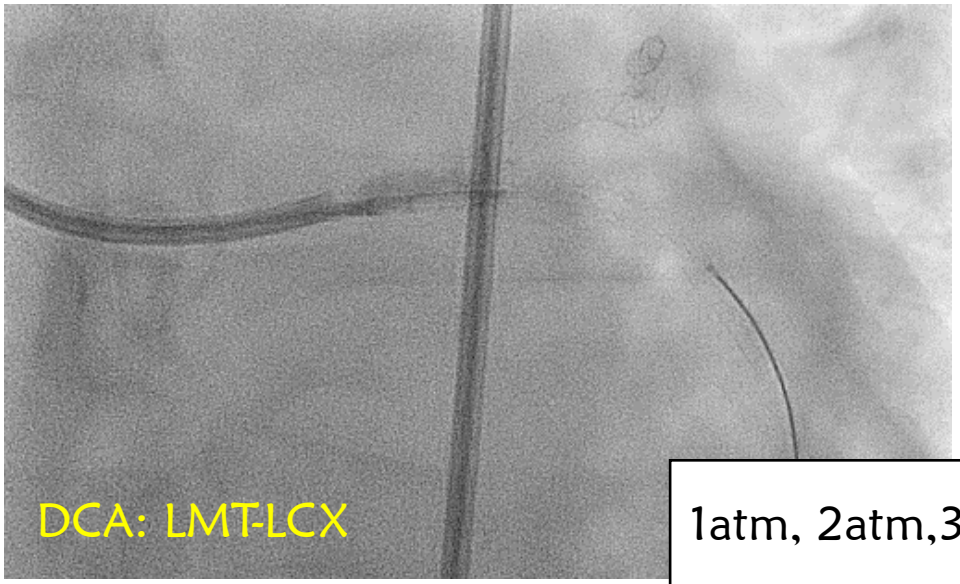
Cutting Gradually





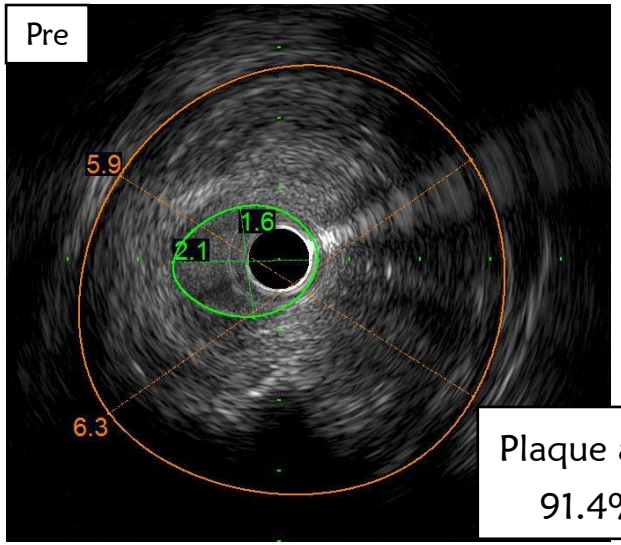
Much residual plaque at LCX side

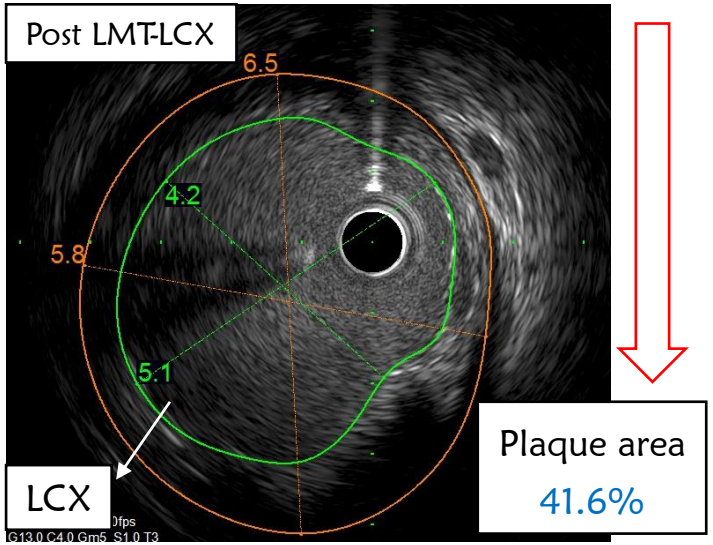
Case 7 : 70's male: SAP due to Restenosis after V-Stenting in LMT



1atm, 2atm,3atm

Cutting Gradually





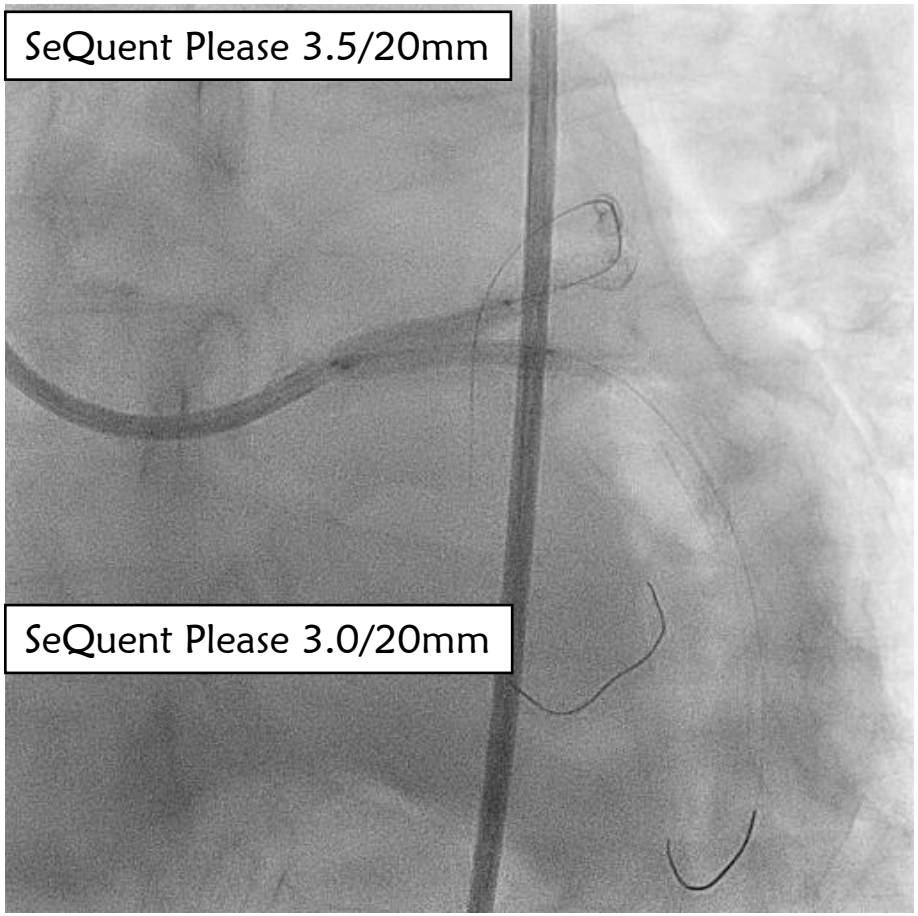
Plaque area
91.4%

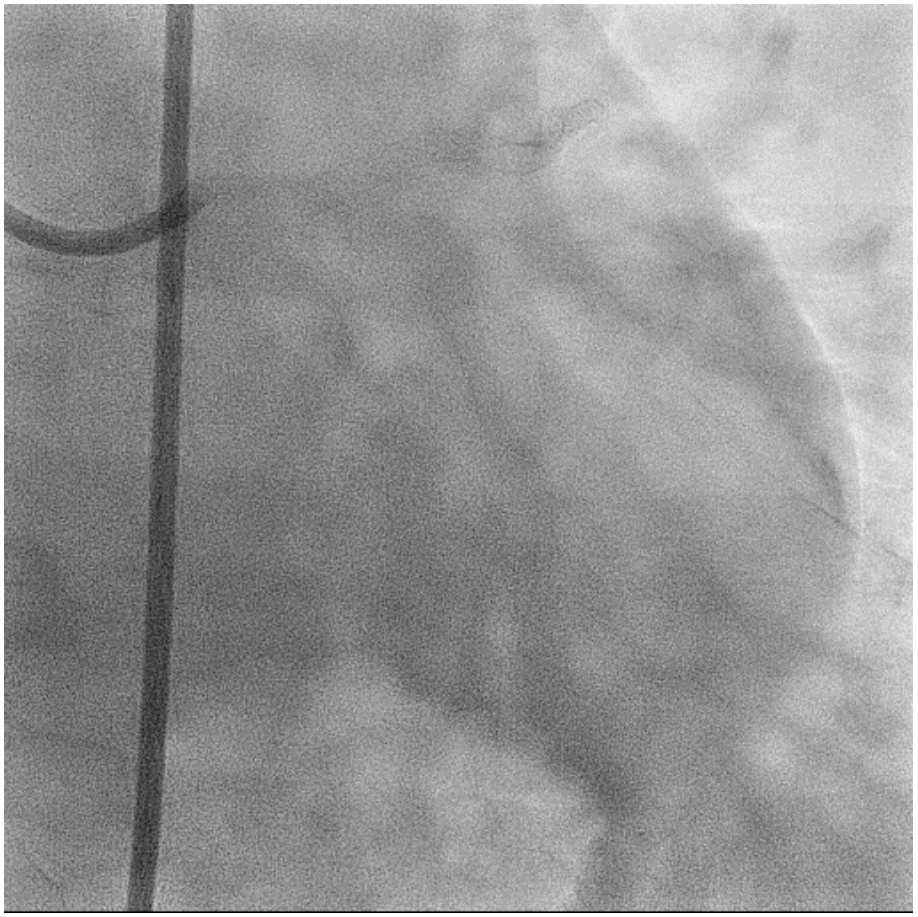
→

Plaque area
41.6%

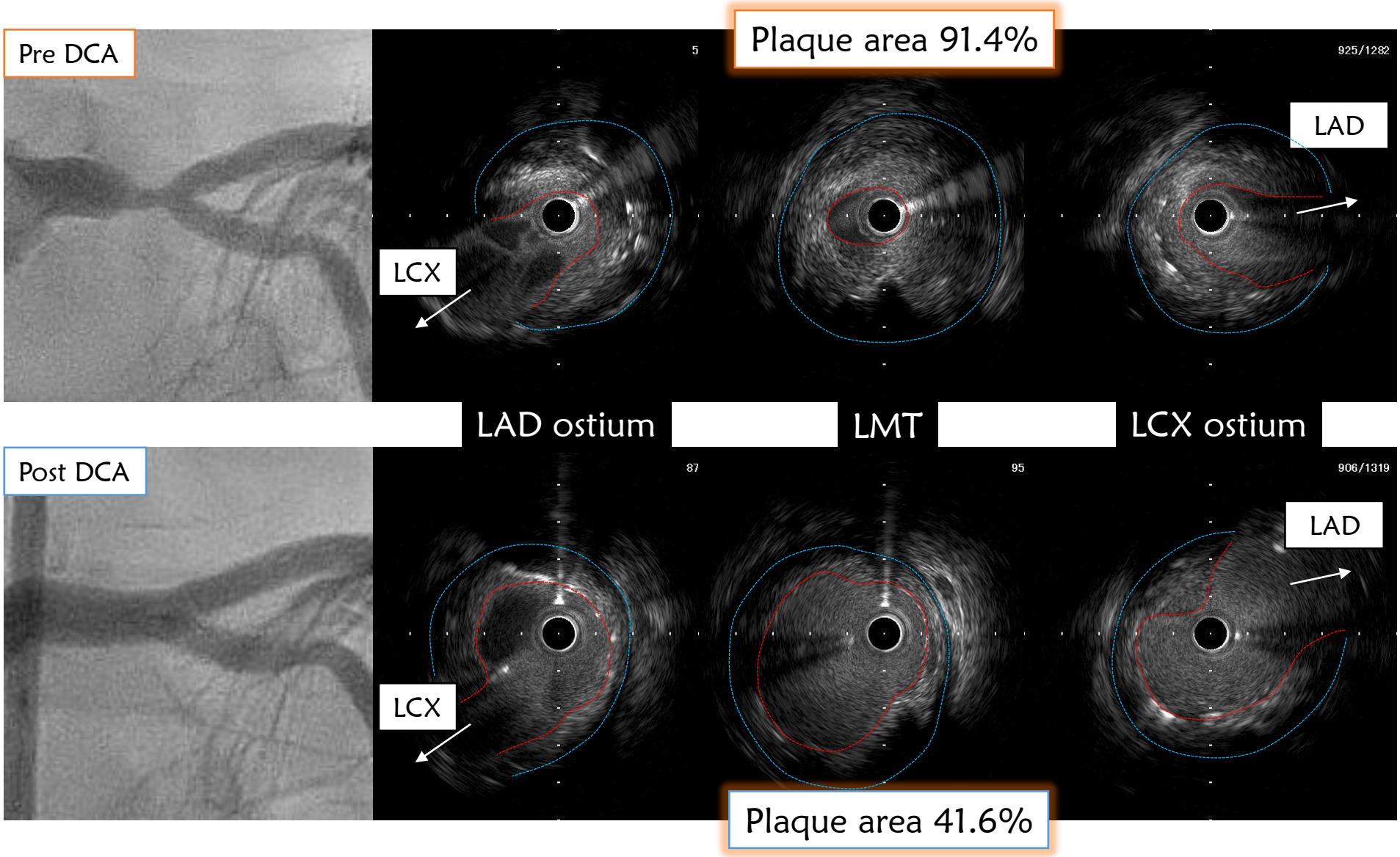
Case 7 : 70's male: SAP due to Restenosis after V-Stenting in LMT

KBT !! With DCBs



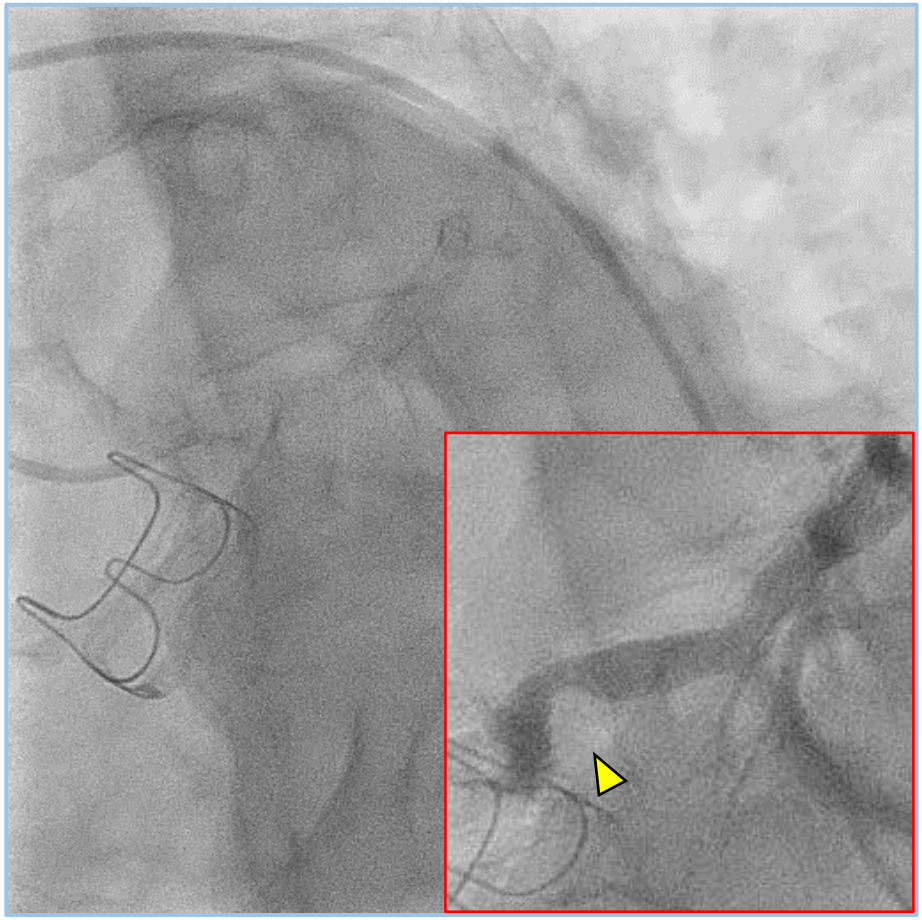


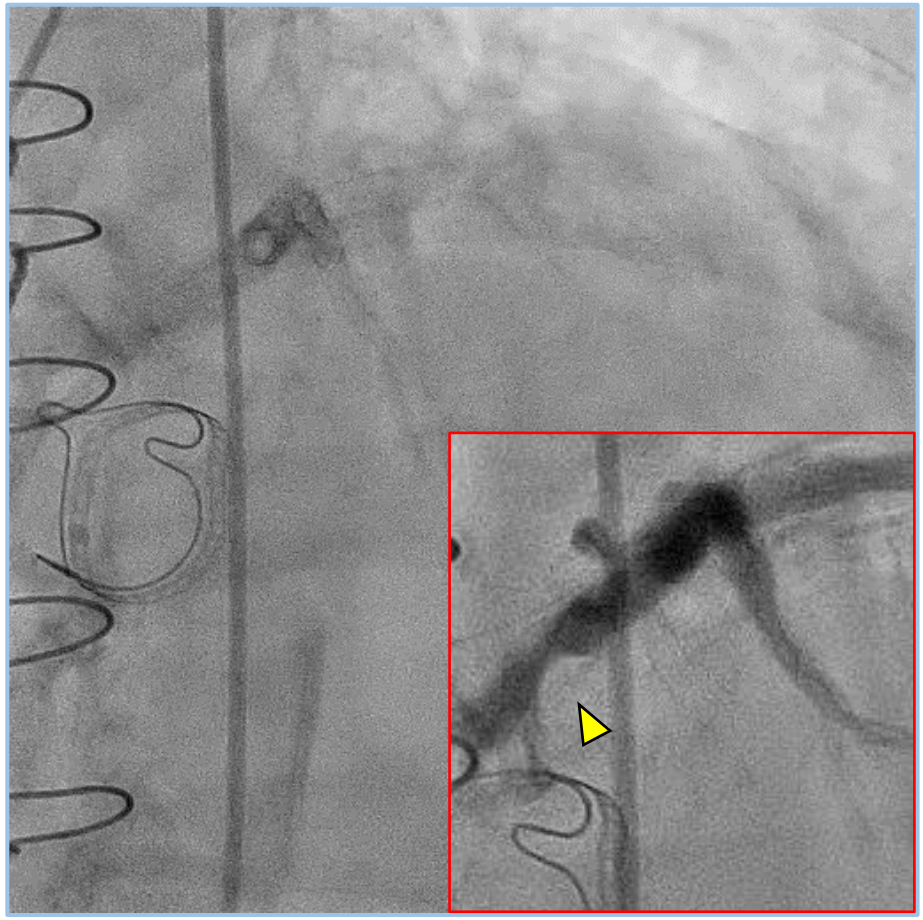
Case 7 : 70's male: SAP due to Restenosis after V-Stenting in LMT



Case 8 : LMT ISR with eccentric NIH : and some Ca.

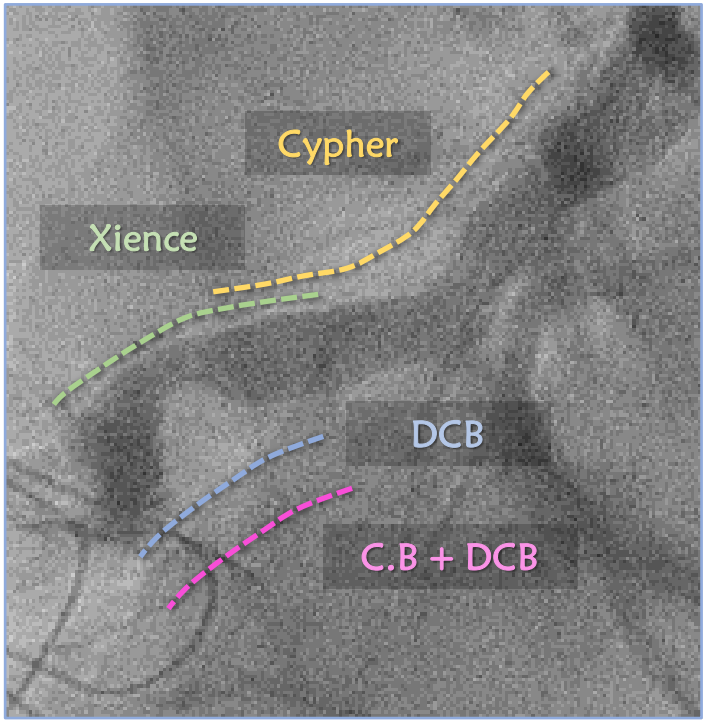
73 yo Male, EF 55.4% (antero-septal moderate hypo) Cre 0.78mg/dl (eGFR 68)





Significant ISR in proximal LMT

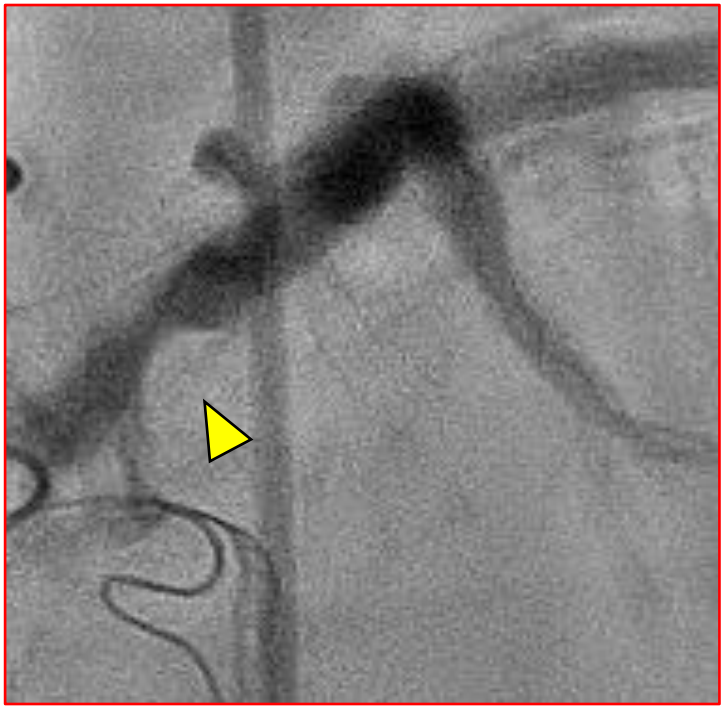
History of multiple interventions for the proximal LMT



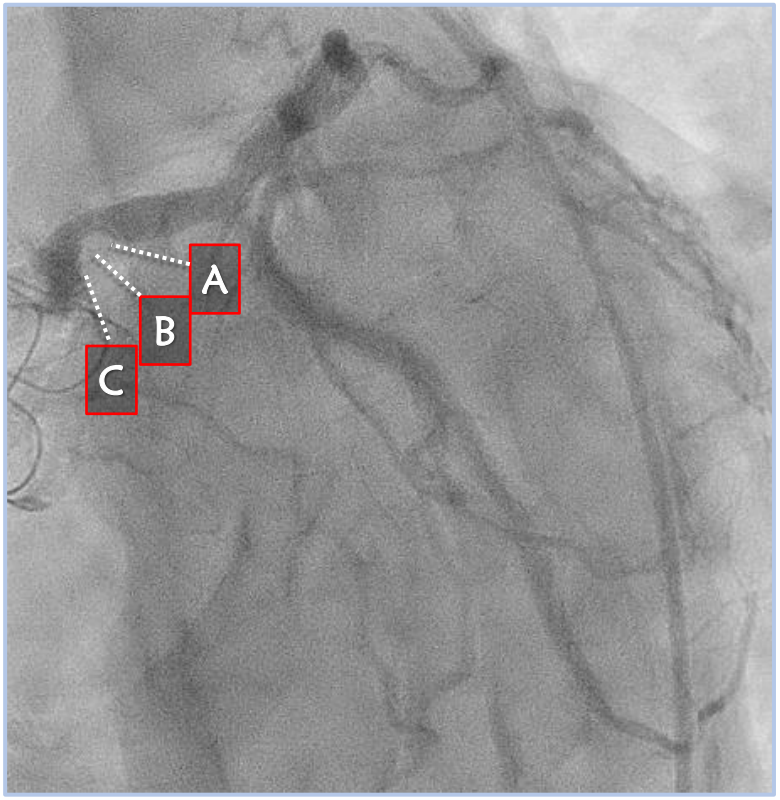
- ✓ PCI for LMT-LAD: Cypher
- ✓ PCI for LMT os-mid: Xience
- ✓ PCI for LMT ISR: DCB
- ✓ PCI for LMT ISR: Cutting balloon + DCB

would never like to Rota !!

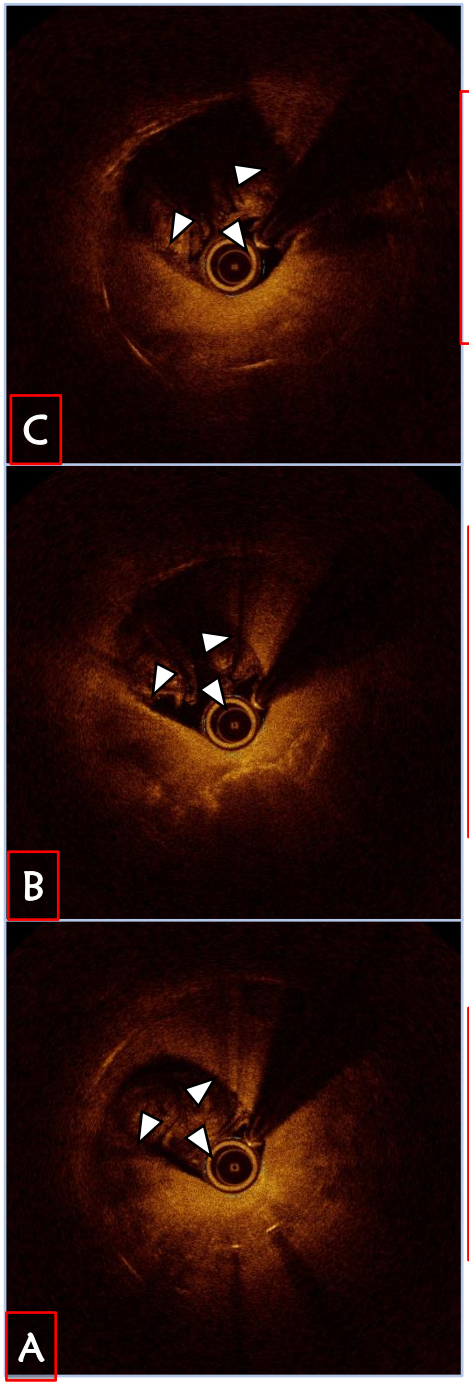
Technically less possibility



Pre OCT



Eccentric NIH with neoatheroscrelosis



Neoatherosclerotic change

➡ Fibrotic plaque

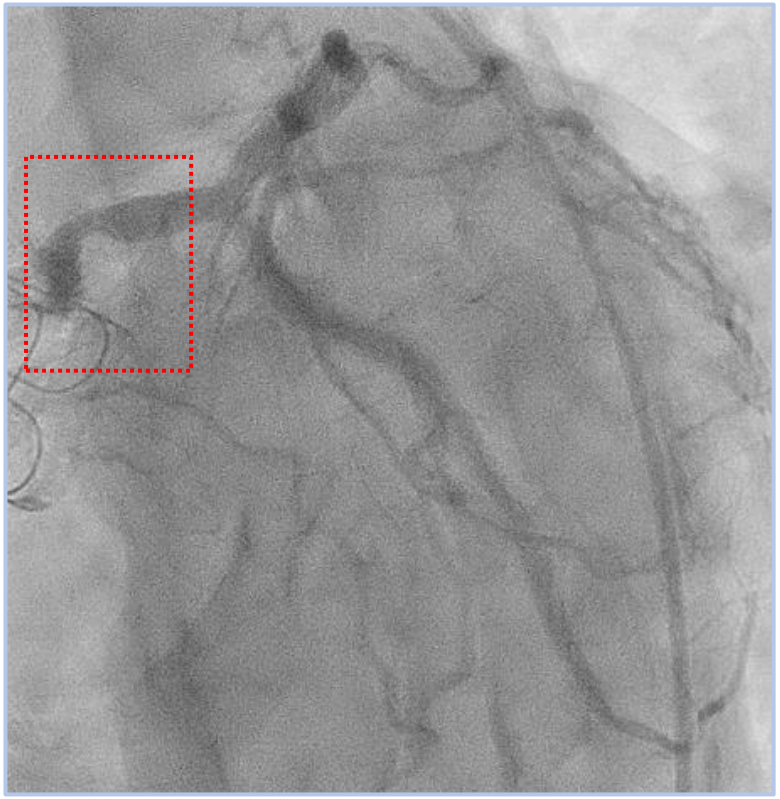
Neoatherosclerotic change

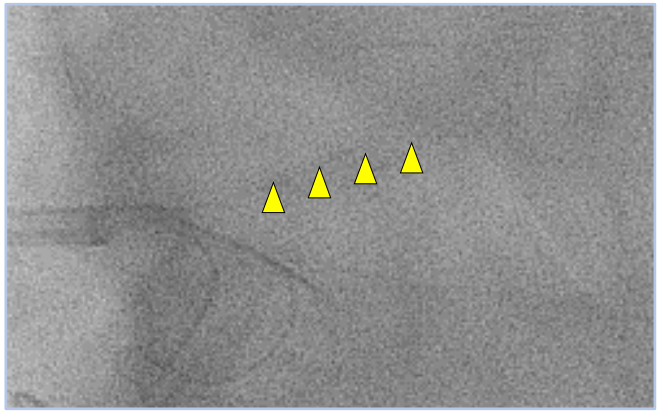
➡ Deep calcification
Lipid plaque

Neoatherosclerotic change

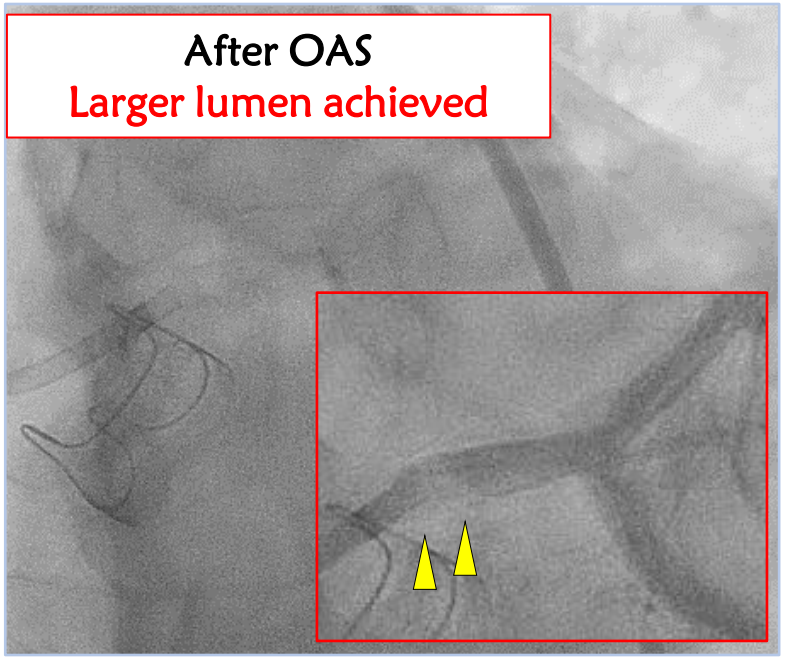
➡ Lipid plaque

Lesion preparation with orbital atherectomy: Diamondback

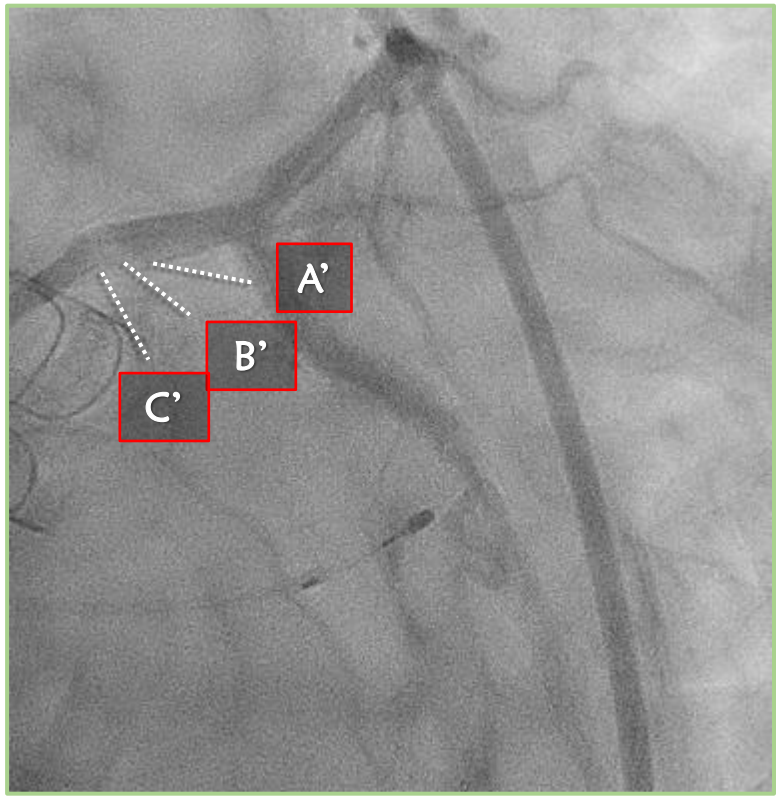




Diamondback (1.25mm): 120,000 rpm

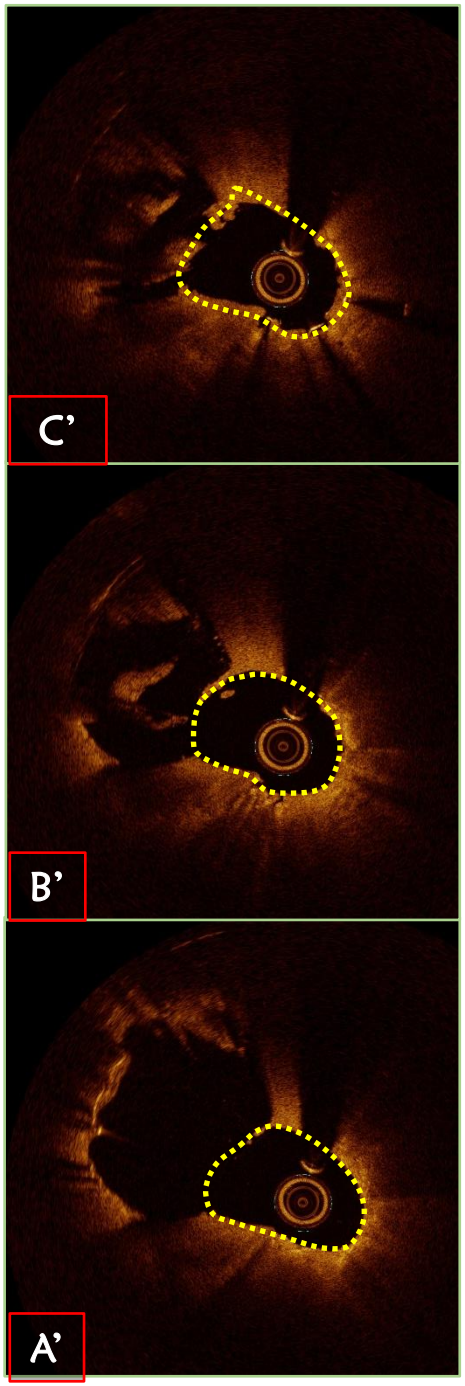


OCT after OAS



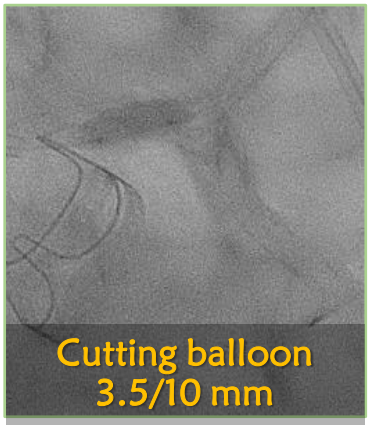
According to the wire bias,

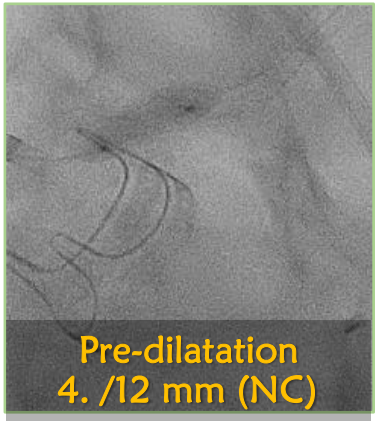
nicely debulked eccentric NIH

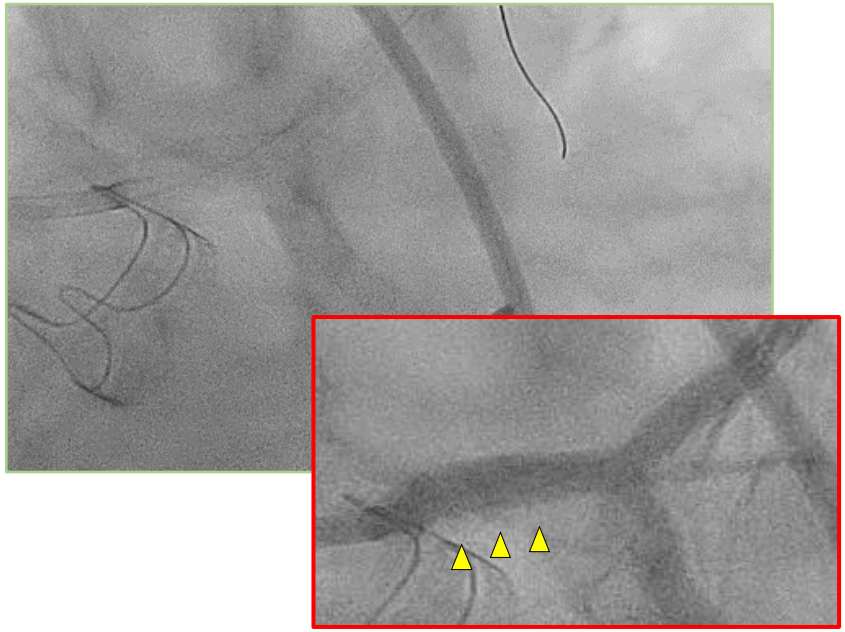


Stent implantation after the effective plaque volume reduction

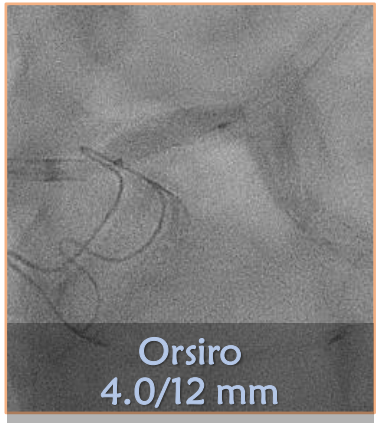
CB and NC preDila.

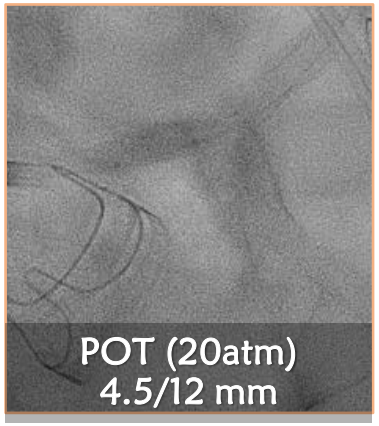


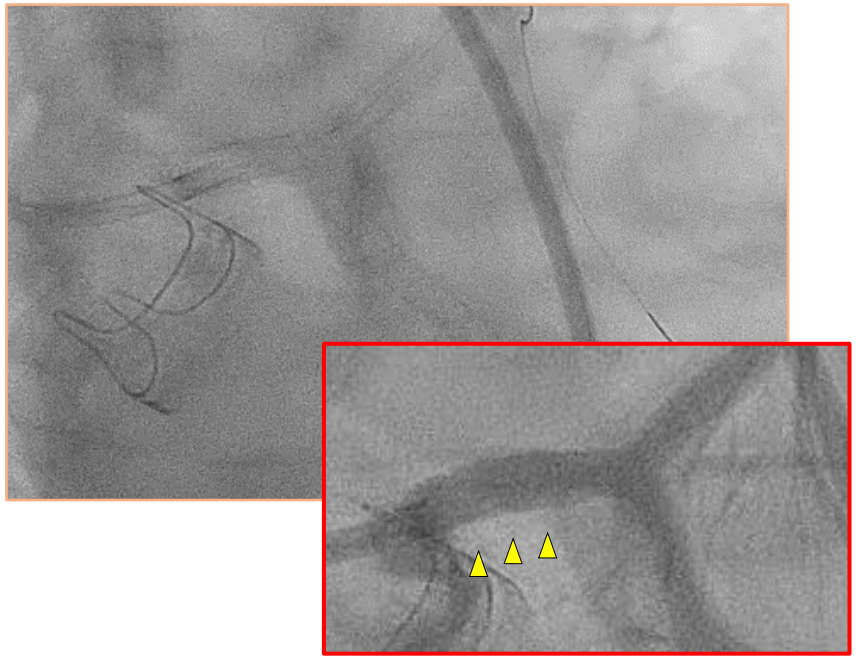




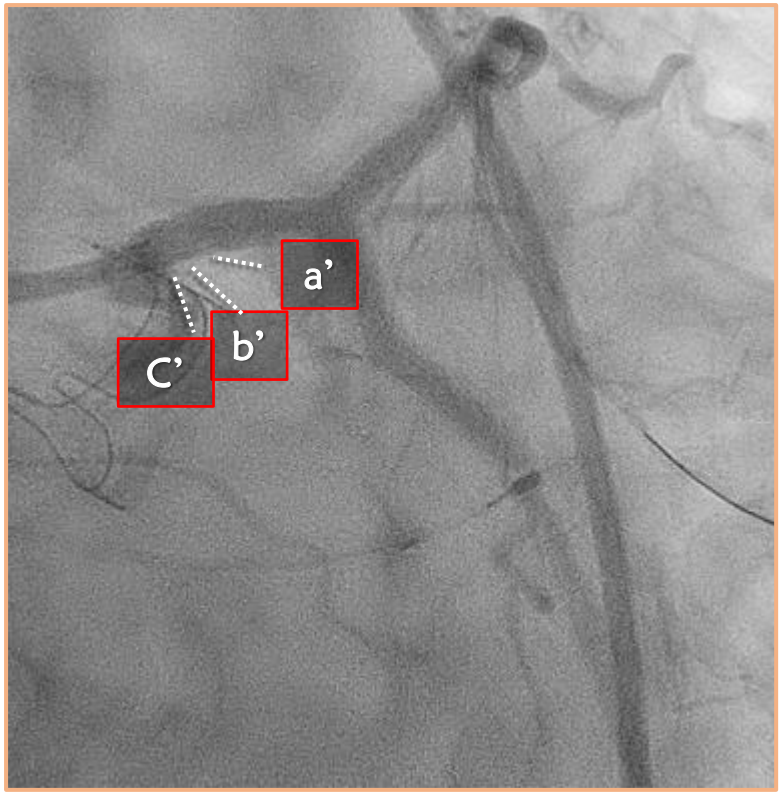
After Stent

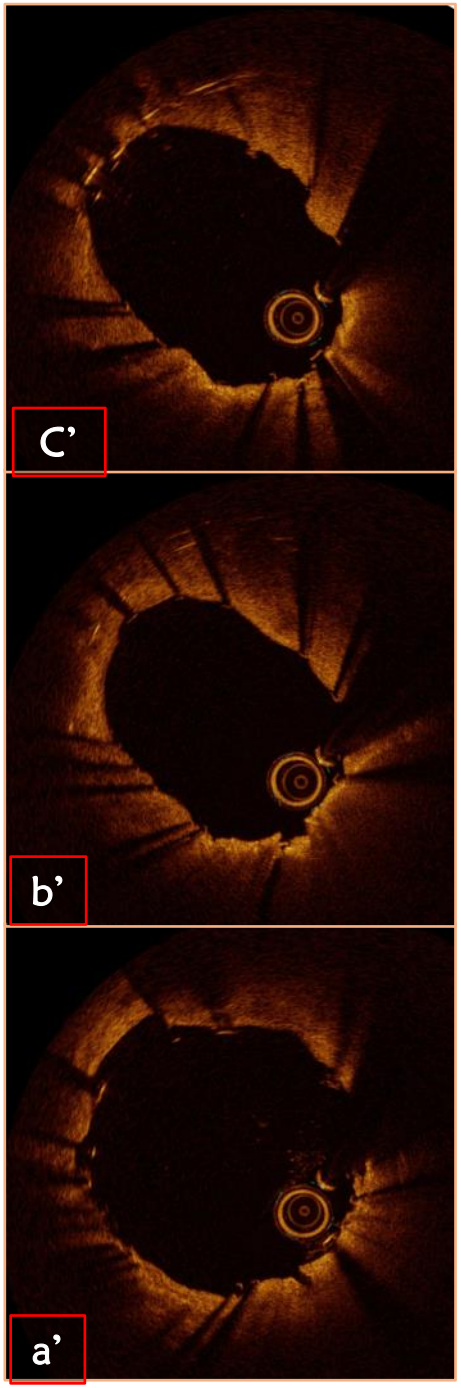






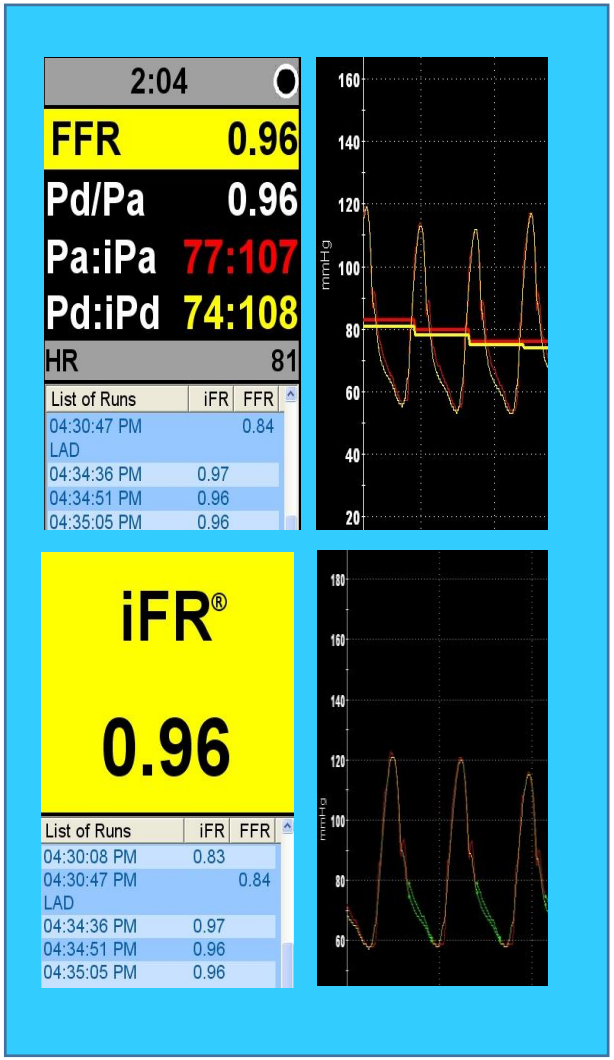
OCT after Stent





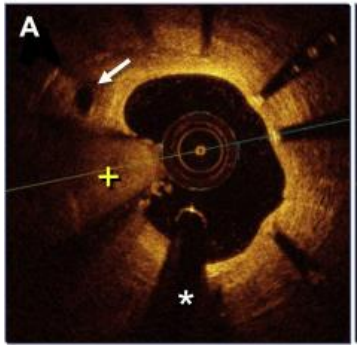
Because of the effective plaque reduction,
larger lumen could be achieved,
even after multiple layered stenting.

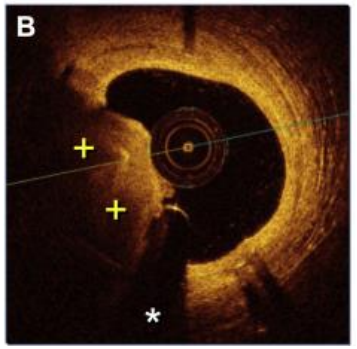
Case 8 : LMT ISR with eccentric NIH : and some Ca.



Final angiography: Excellent results

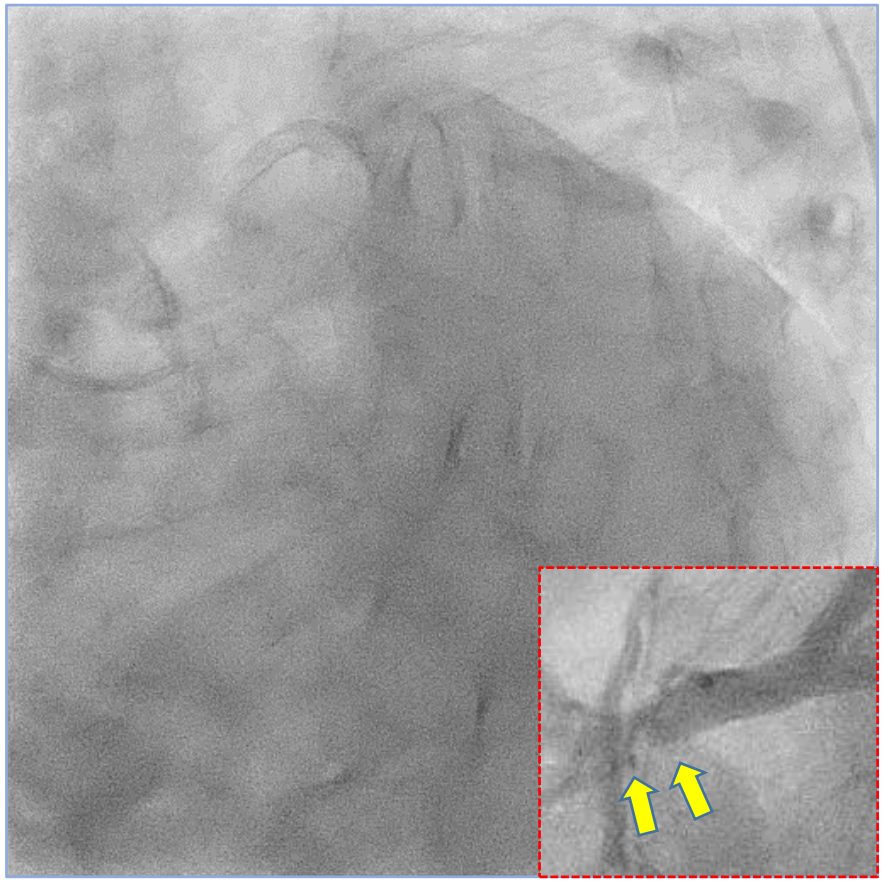
Calcified Nodule

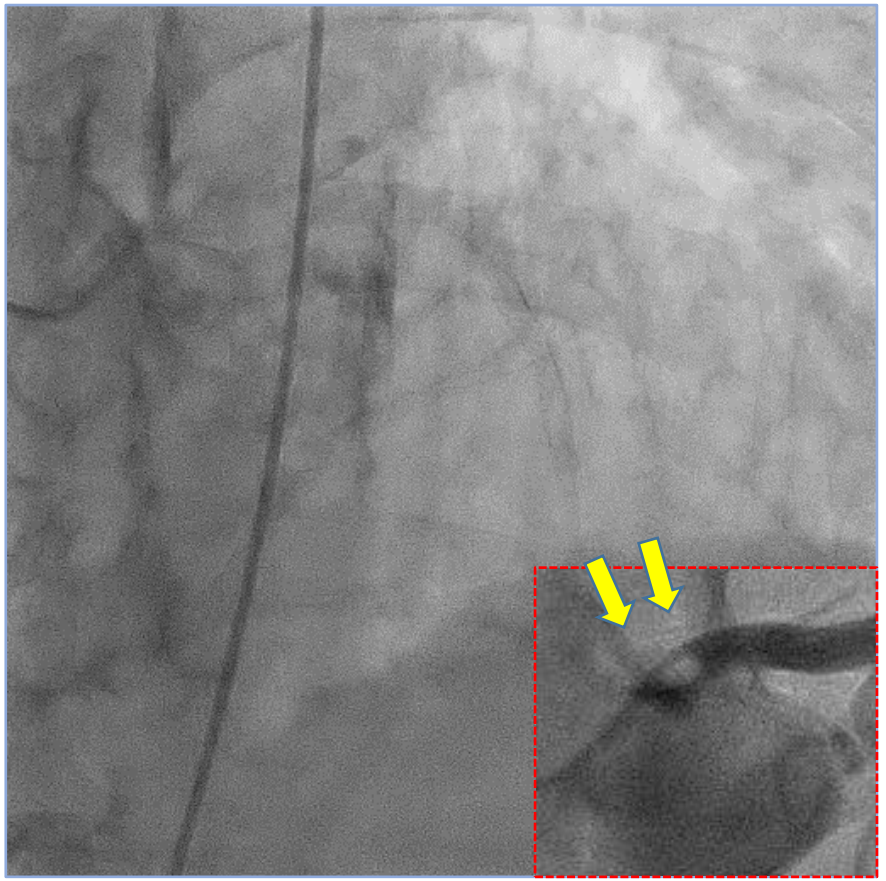




Case 9 : 60's Male HD ; SAP, LMT ISR with calcified nodule

HD patients, Coronary risk factors: HTN, DL, IDDM, EF 55.4% (antero-septal Cre 5.63mg/dl (eGFR 9), BNP 1374.0pg/ml LDL-chol 87mg/dl, HDL-chol 32mg/dl, A1c 6.6% EF 48%(modified Simpson),

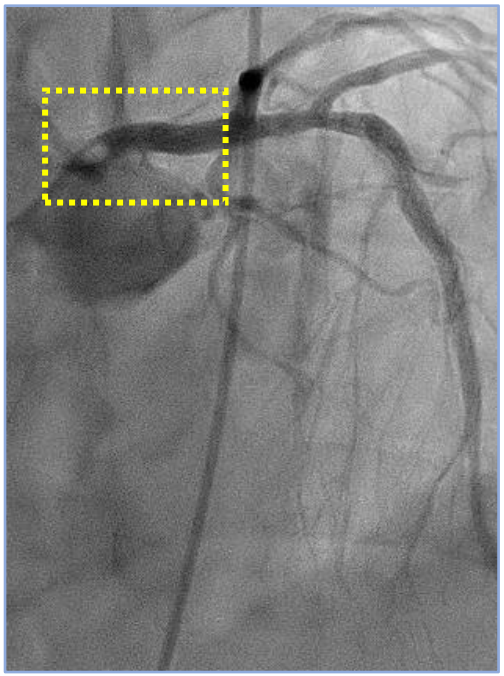


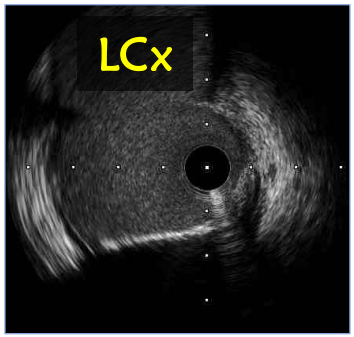


Significant ISR in proximal LMT

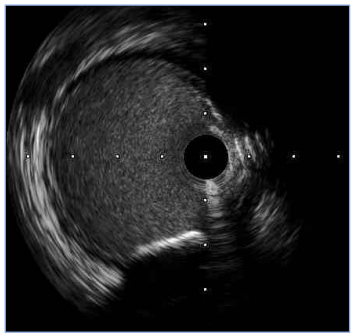
OCT images : Baseline !!

Preprocedural
IVUS evaluation

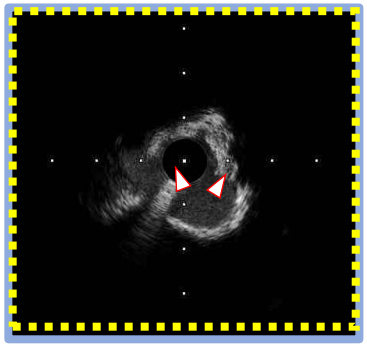




LMT distal bifur.

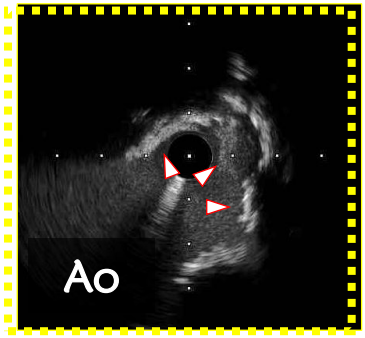


LMT body



LMT lesion

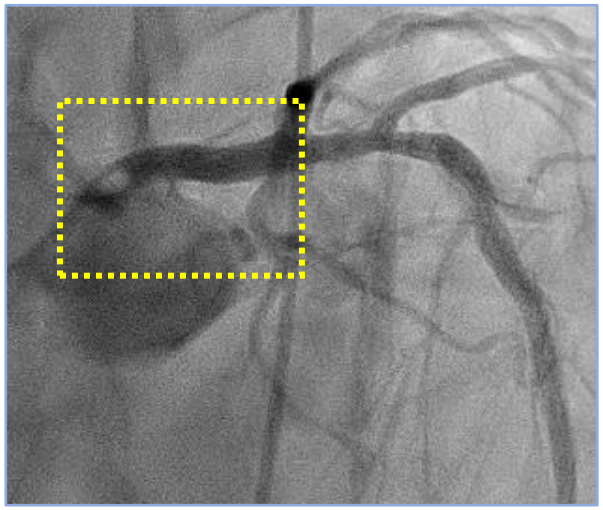
Severe stenosis
with calcified nodule

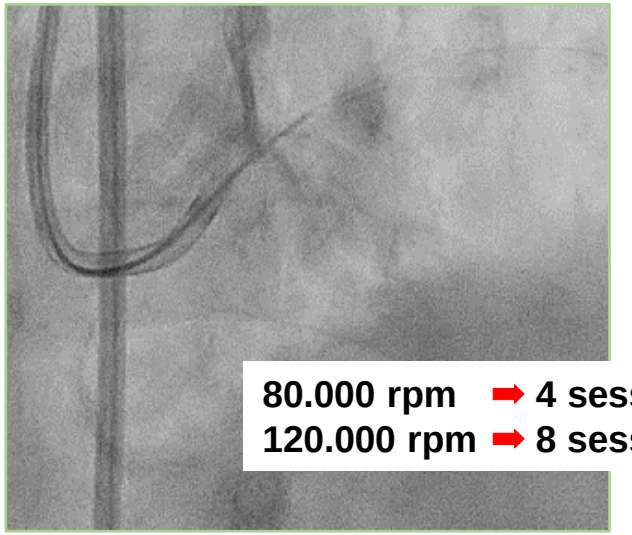


LMT os

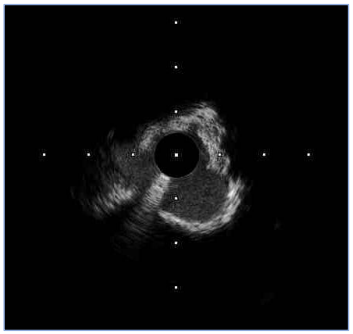
Severe stenosis
with calcified nodule

OCT images before and after OAS

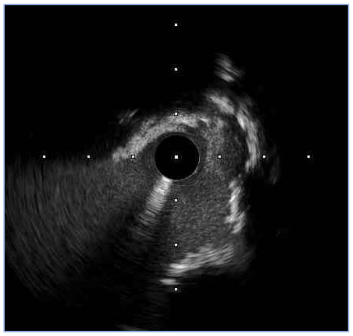


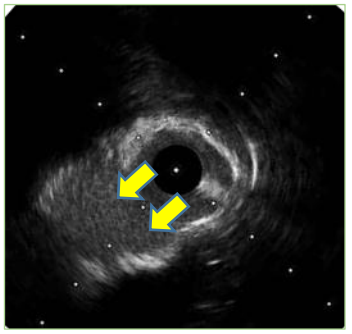


Diamondback for calcified nodule in LMT

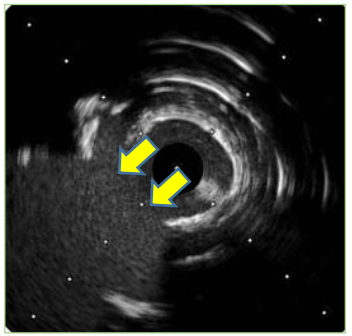


Baseline



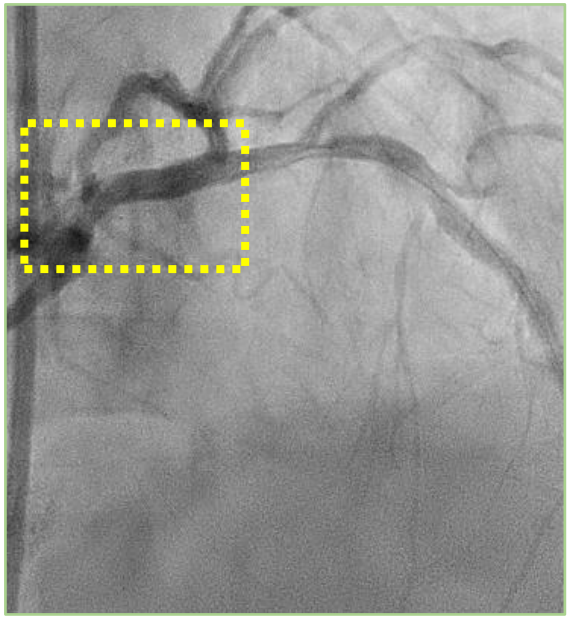


After OAS



lesion modification with Diamondback

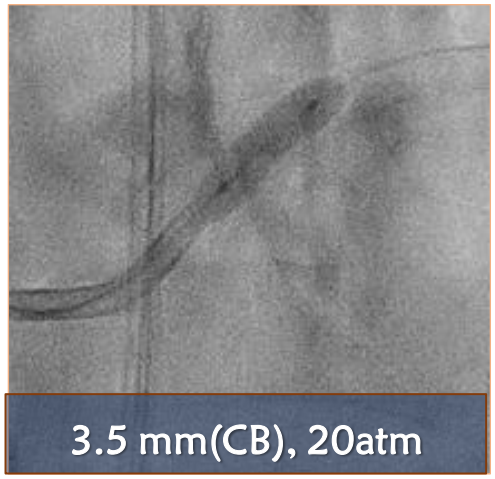
Case 9 : 60's Male HD ; SAP, LMT ISR with calcified nodule

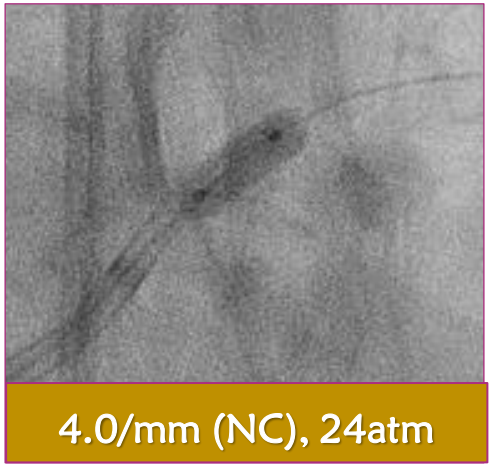


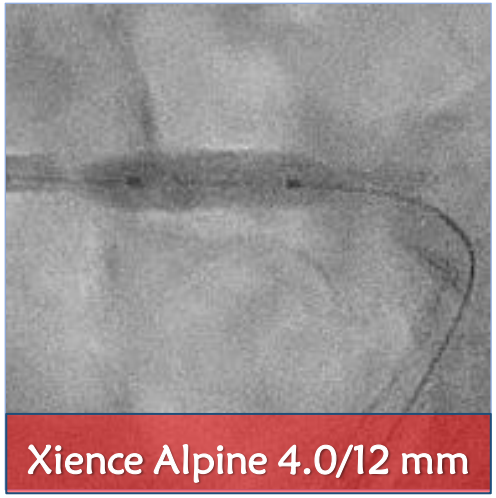
Additional

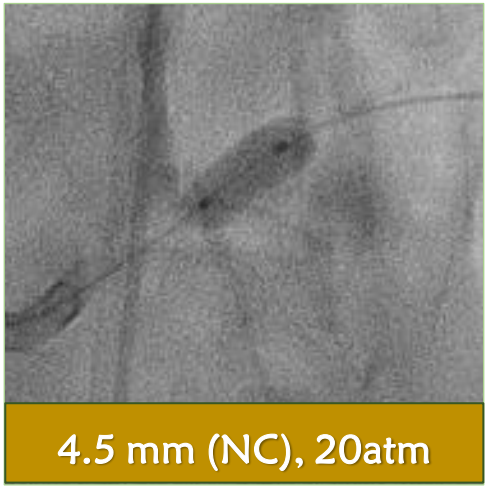
lesion preparation

And Stenting





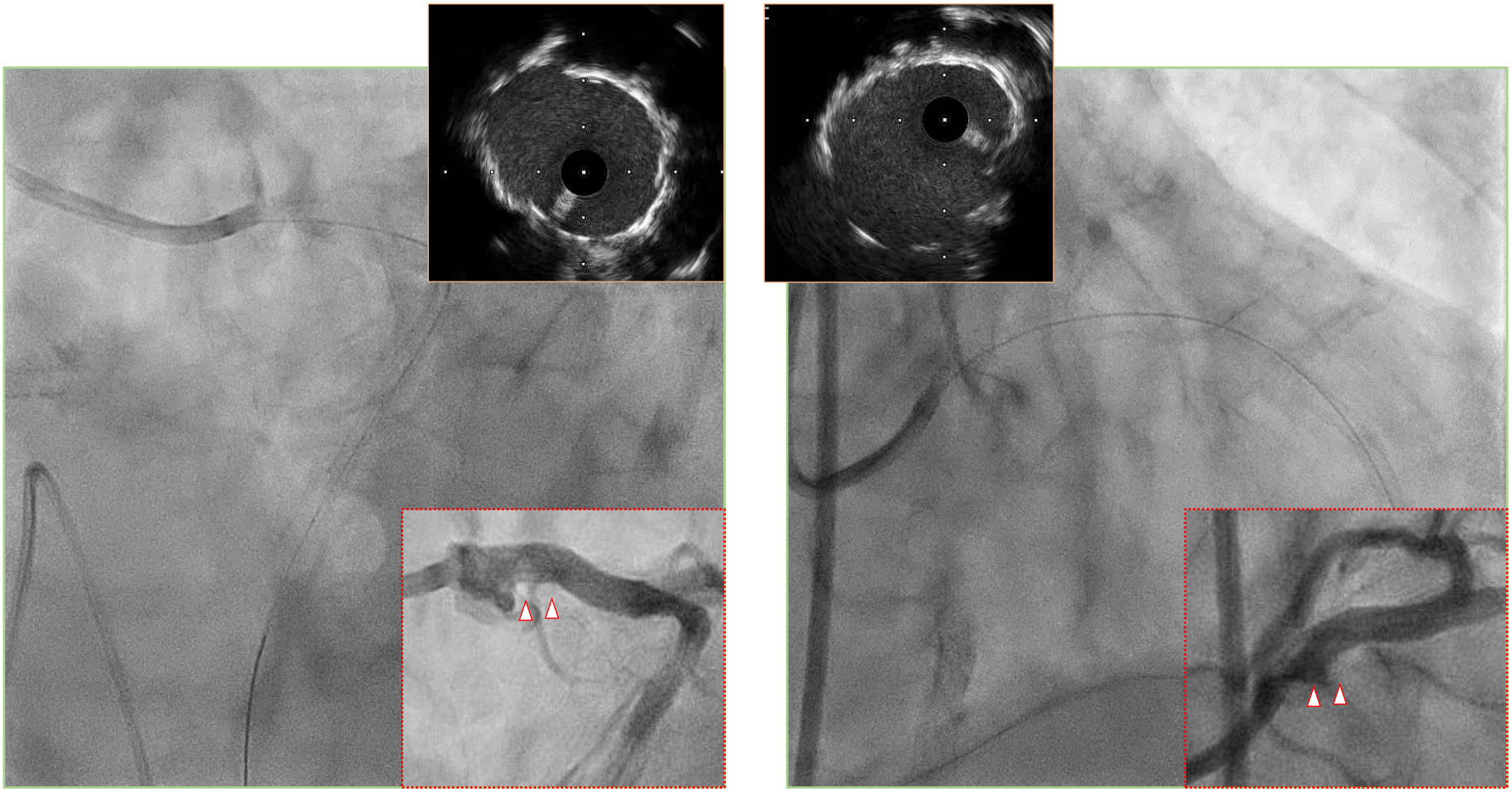




Stent implantation and optimization

Case 9 : 60's Male HD ; SAP, LMT ISR with calcified nodule

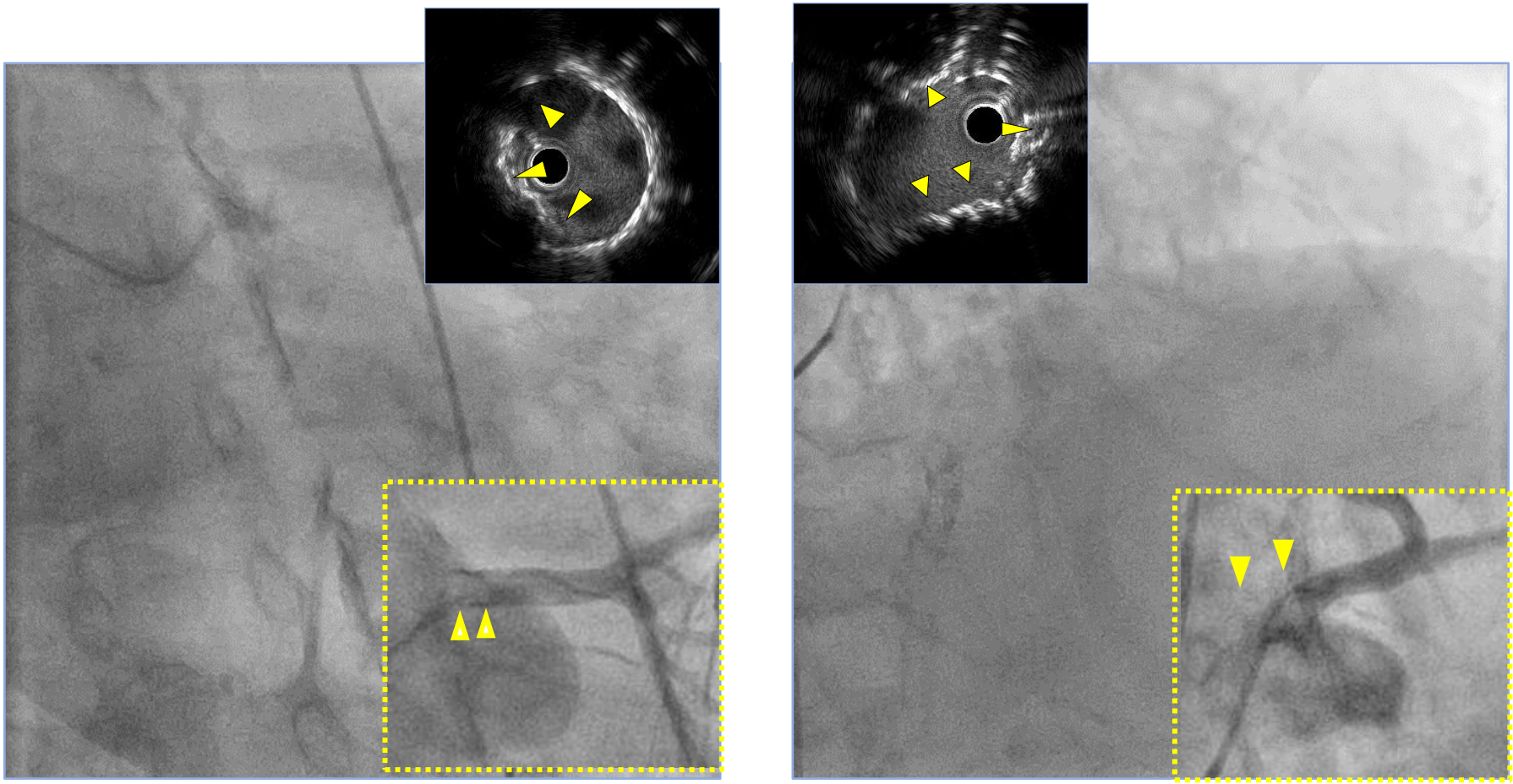
Final angio. ➡ Excellent: results with Optimal stent expansion and apposition MSA: 10.35mm^2



Final

Case 9 : 60's Male HD ; SAP, LMT ISR with calcified nodule

Unfortunately…1 Year later, Pt. symptom recurrence !! RESTENOSIS !!



The patient was sent to CABG

Collection of famous Quotes by Antonio Colombo

= Left Main Stem PCI : ISR=

1. Mortality after TLR for left main stent failure is high. So should pay close attention to maximize your PCI technique for avoiding RESTENOSIS !!

2. Impact on prognosis is strongly related to clinical presentation and extent of coronary artery disease, So should blush-up your skill to the limit of you

3. Strategy for LMT- ISR should be personalized one which is depend on the Pt's clinical presentation including general condition, location of ISR, lesion morphology which is well understandable by imaging device. And may lead best selection of devices.