

Beyond the CTO: Treatment Strategies for Distal Bed

IVUS guided decision making

Toyohashi Heart Center

Maoto Habara

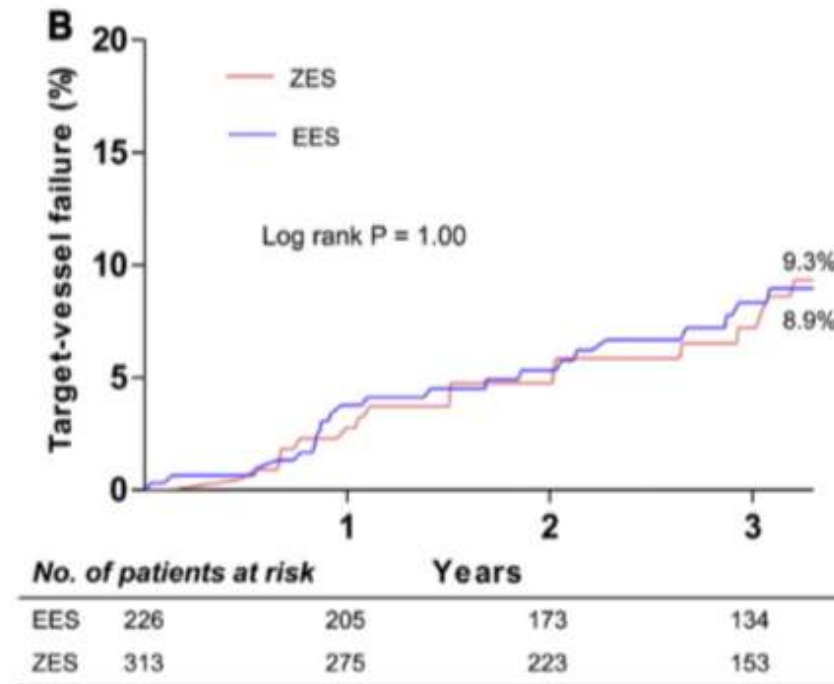
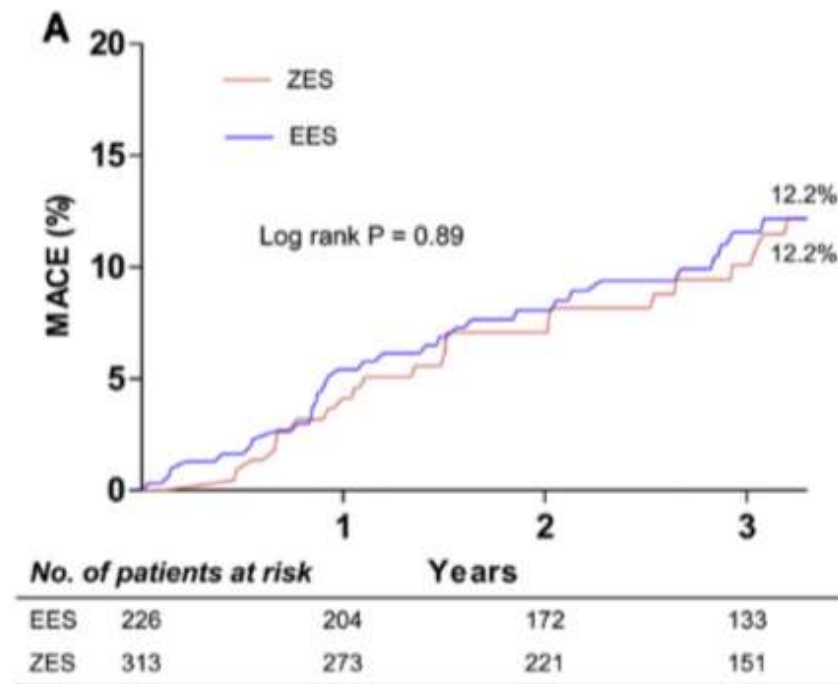


DES improved the outcome of CTO-PCI

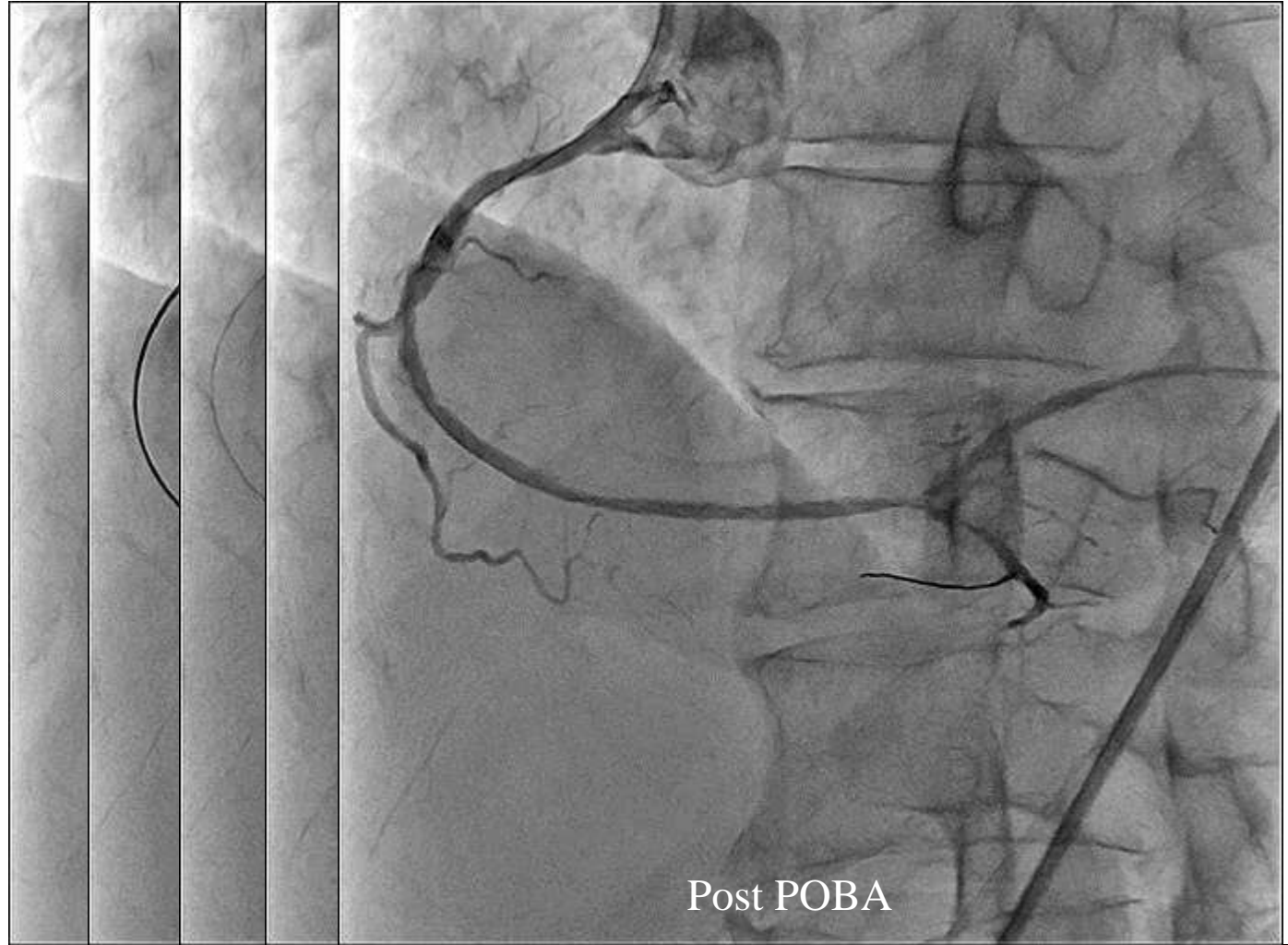
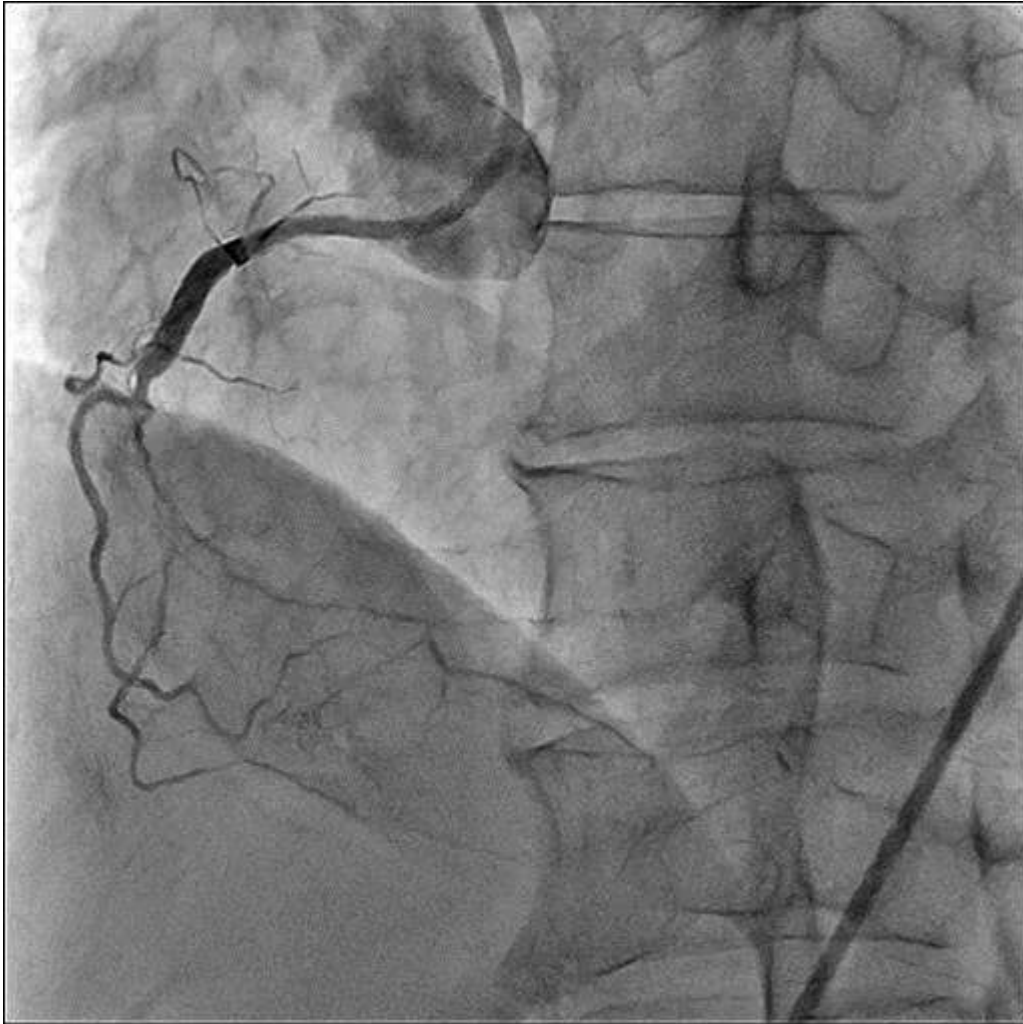
Everolimus- versus zotarolimus-eluting stent following percutaneous coronary chronic total occlusion intervention☆

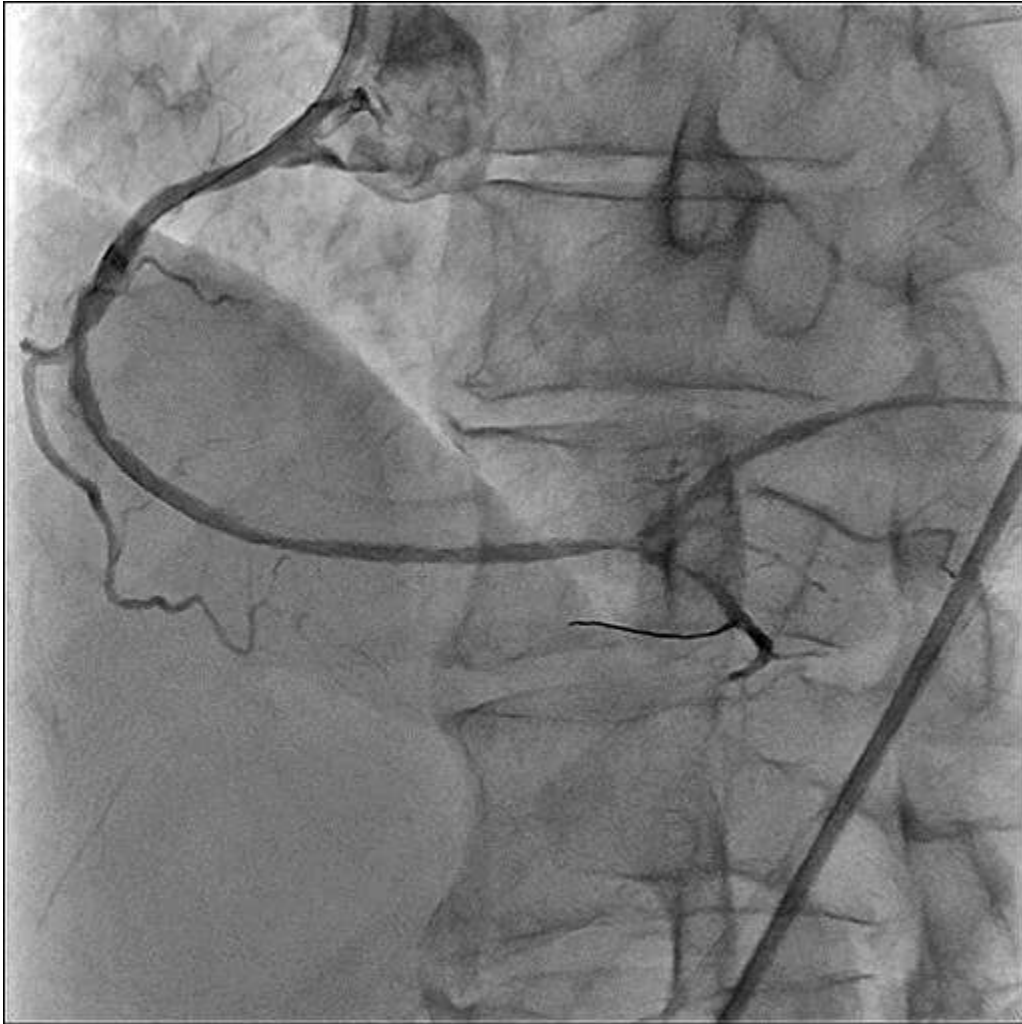
Int J Cardiol 2017;241:128-132

Pil Hyung Lee, et.al.



Case: RCA-CTO (IVUS guide stent implantation)





Where is the optimal stenting site ?



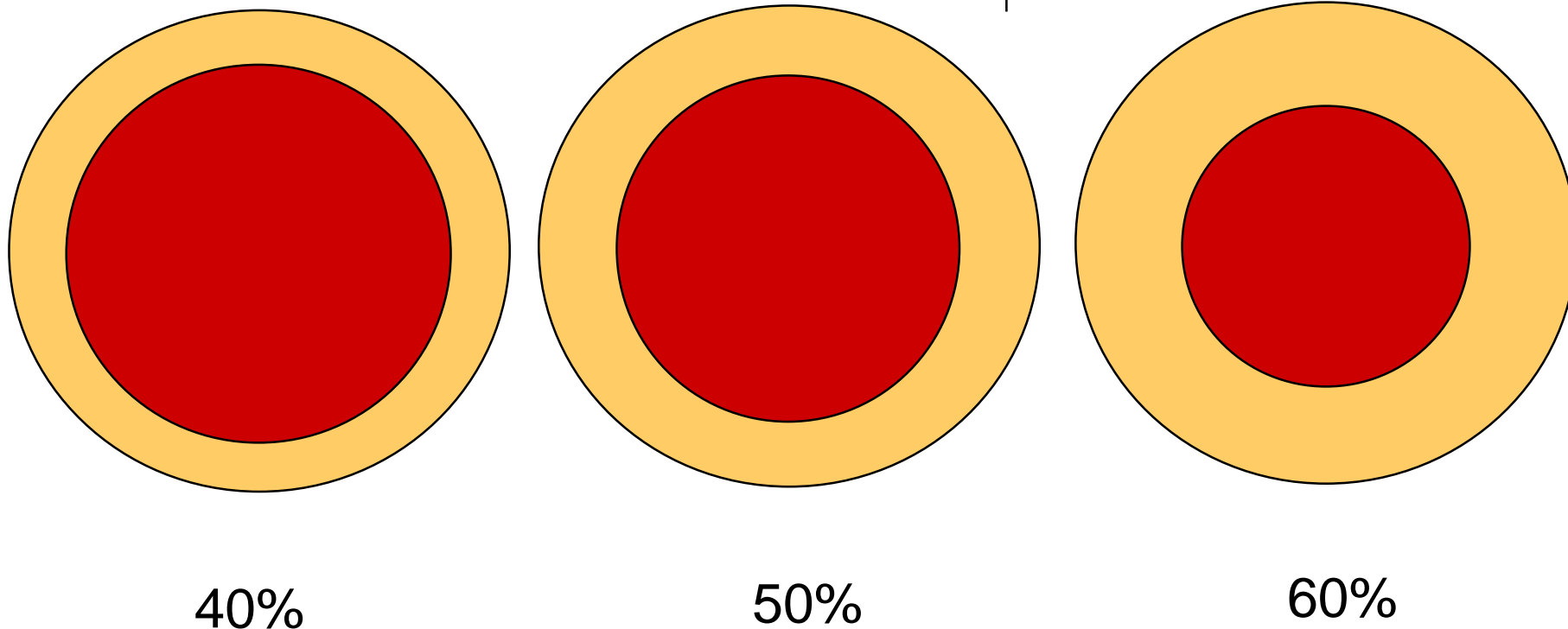
IVUS

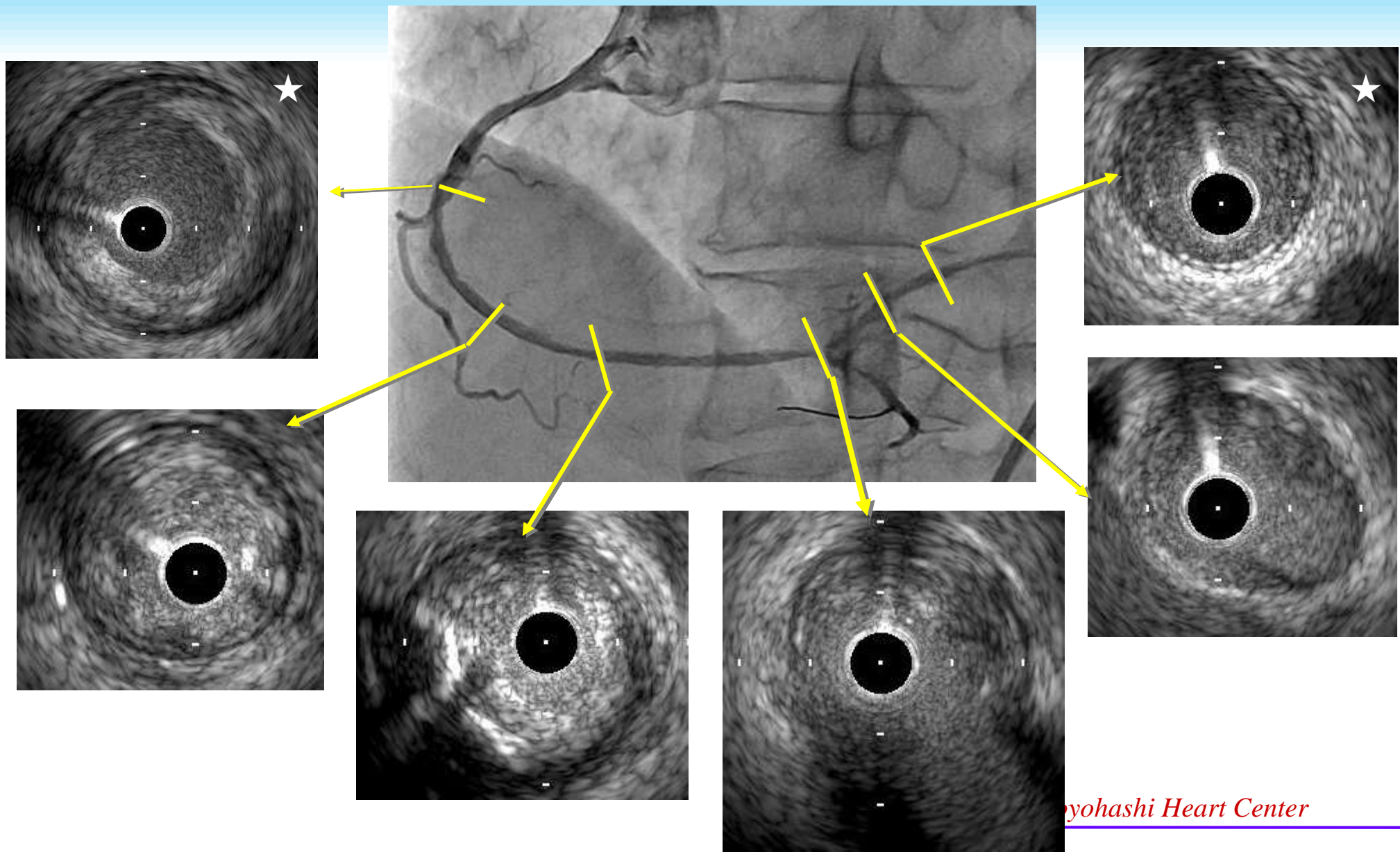


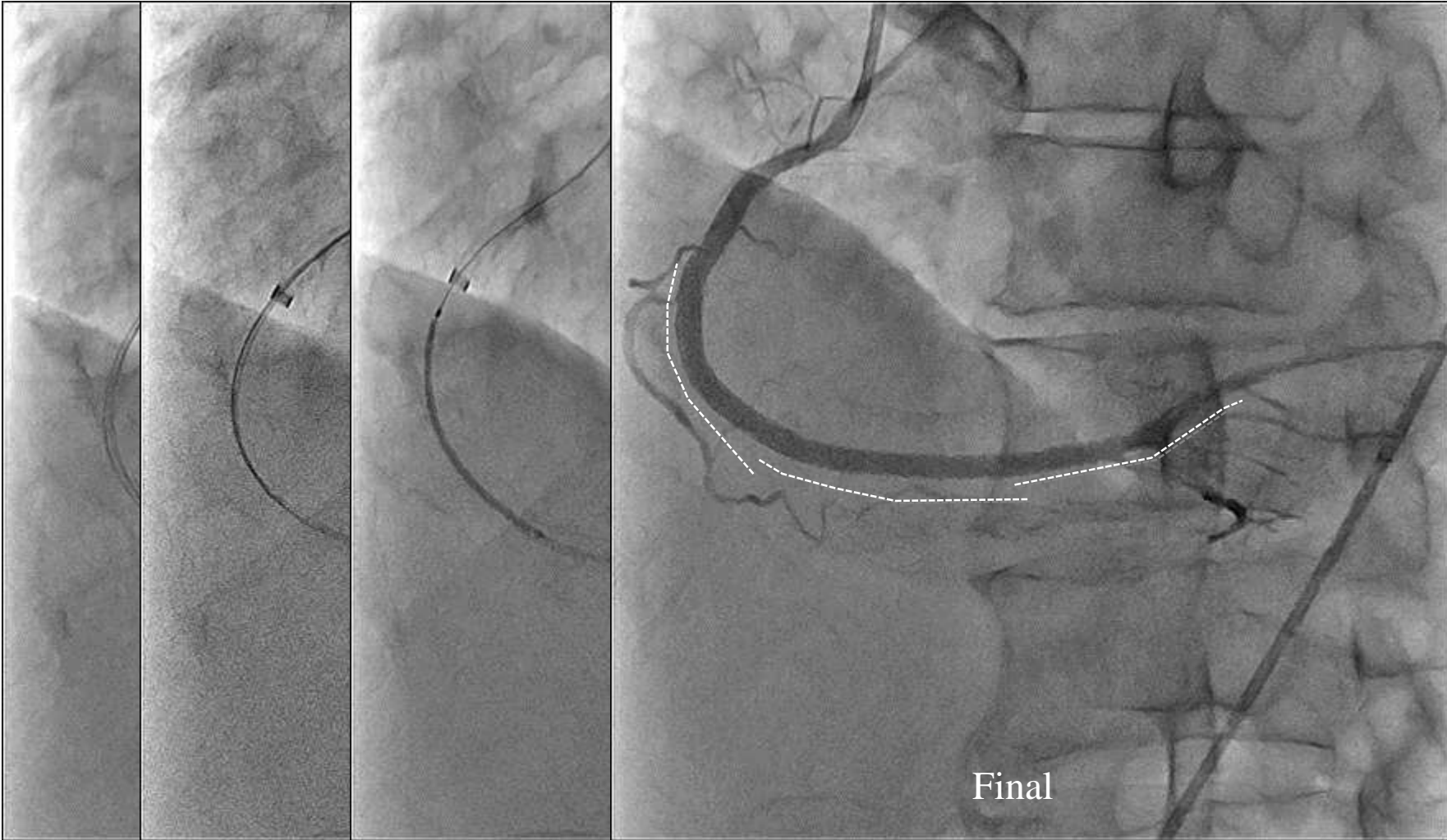
IVUS guided Stent implantation

How to select reference site

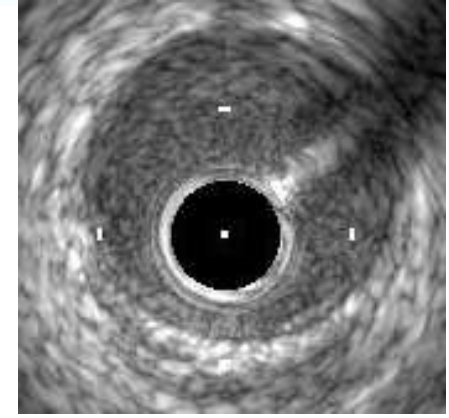
Edge plaque burden < 50% hardly
cause edge restenosis



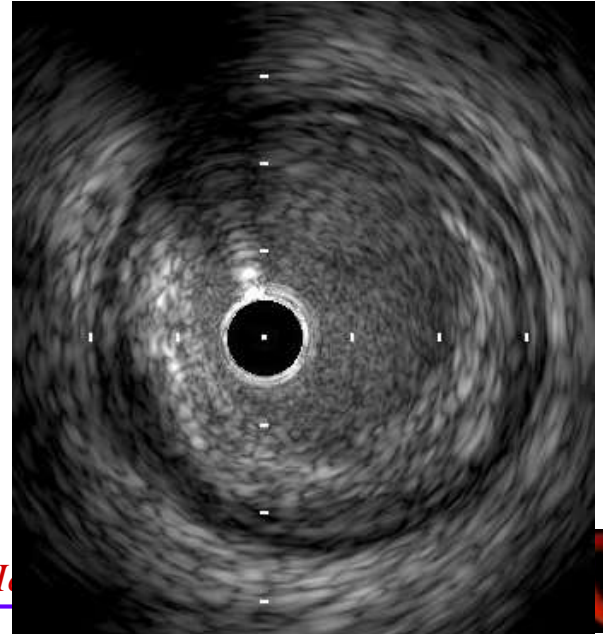




Distal edge



Proximal edge

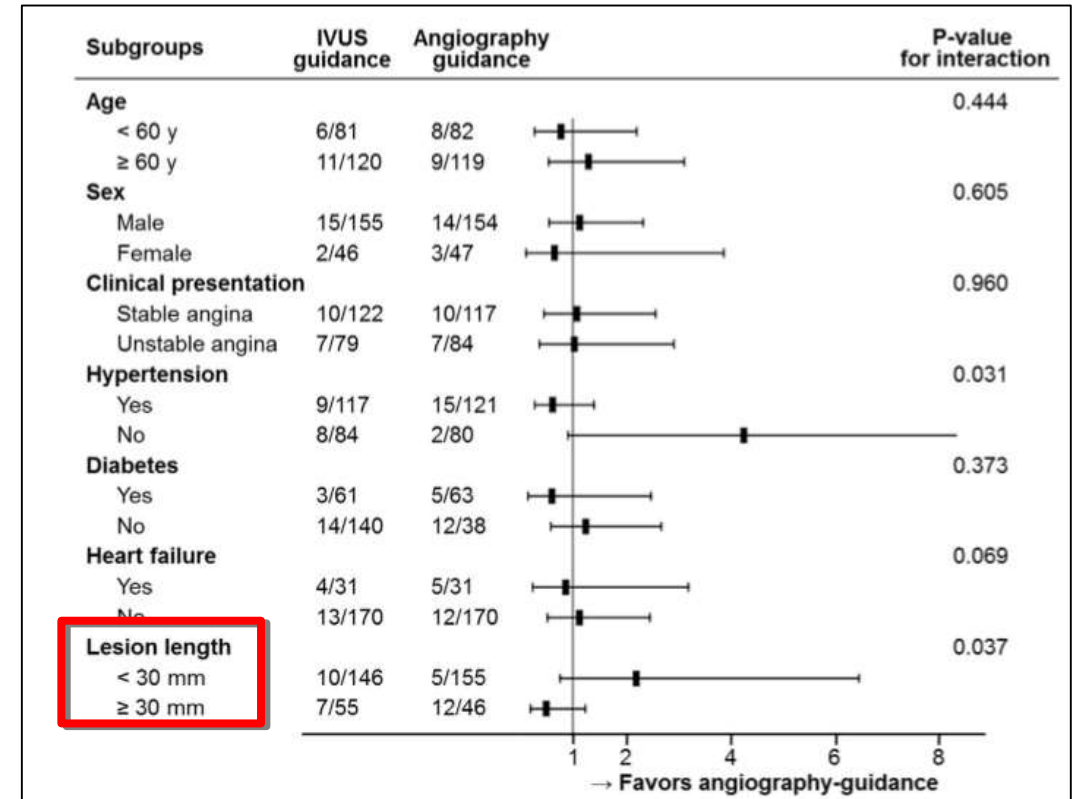
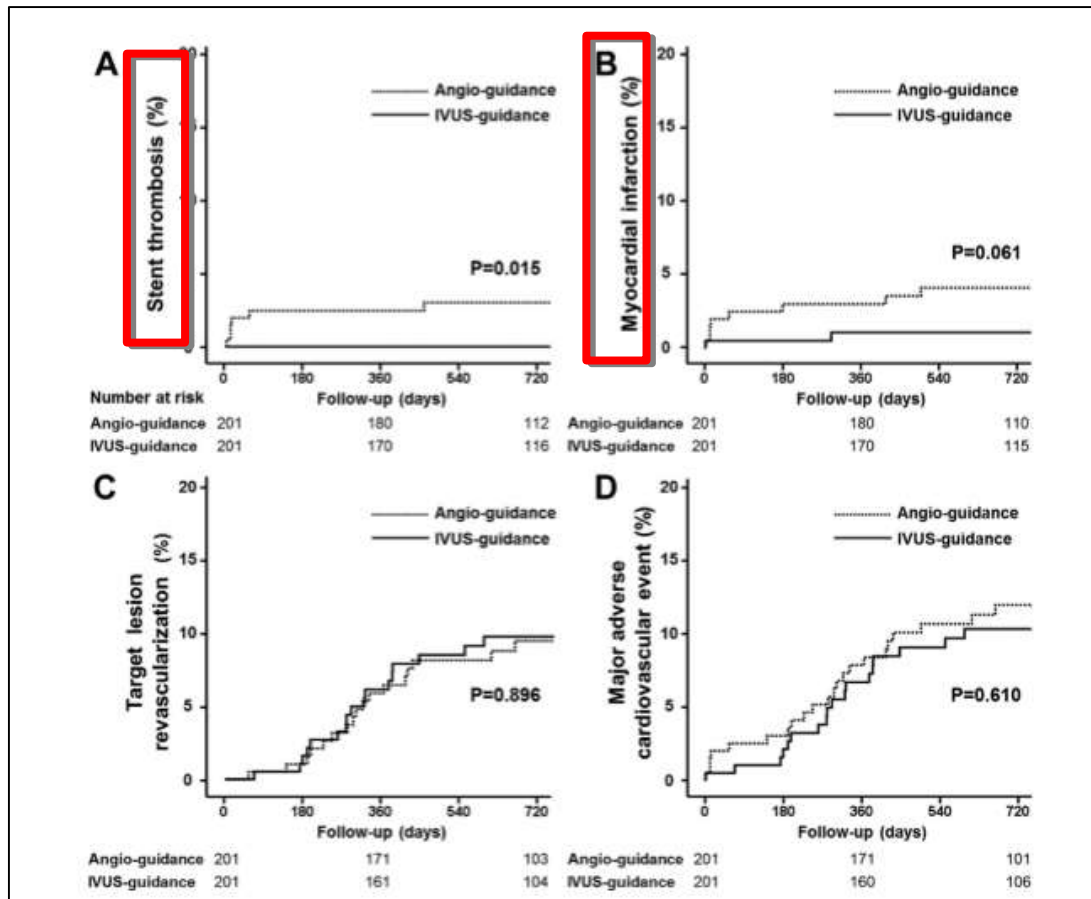


IVUS also improved CTO-PCI outcomes

Usefulness of Intravascular Ultrasound Guidance in Percutaneous Coronary Intervention With Second-Generation Drug-Eluting Stents for Chronic Total Occlusions (from the Multicenter Korean-Chronic Total Occlusion Registry)



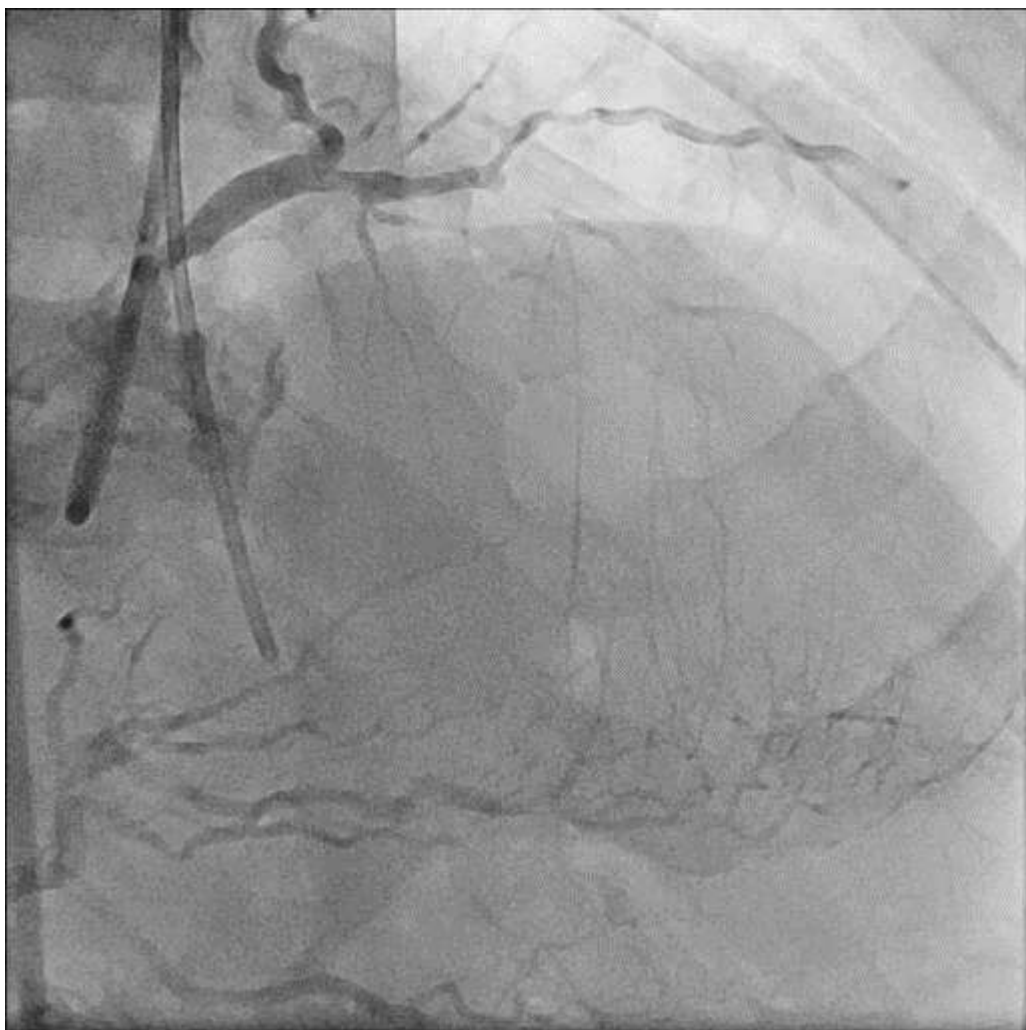
Am J Cardiol 2014;114:534-540
Sung-Jing Hong, M.D. et.al.

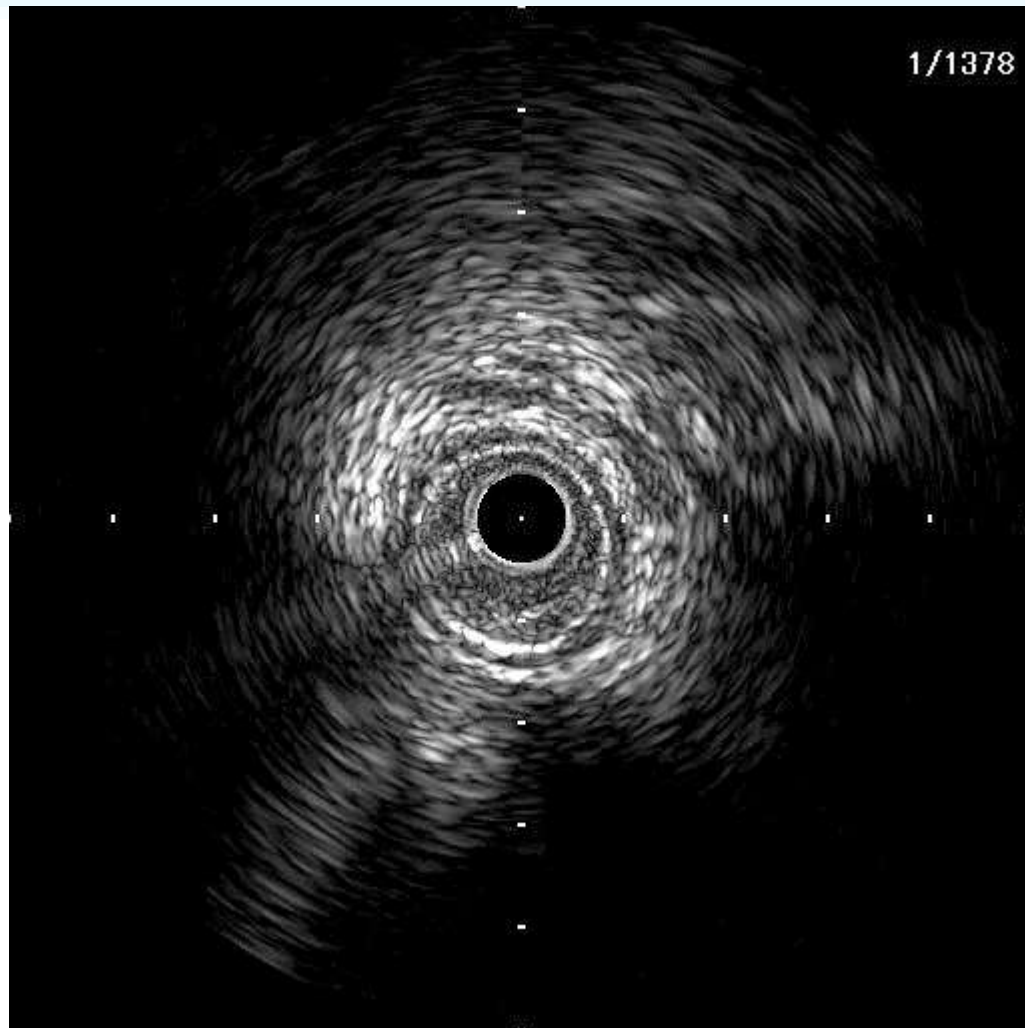
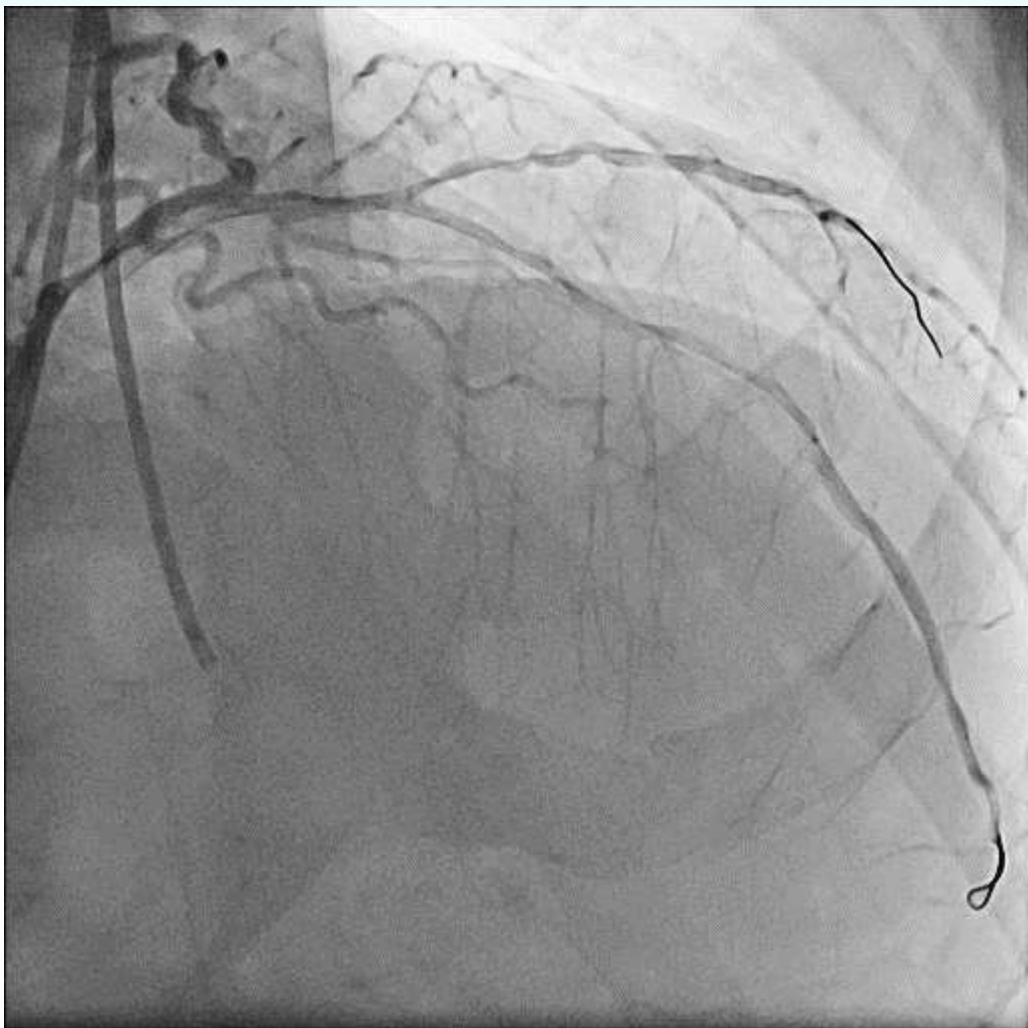


Subgroup analyses of TLR

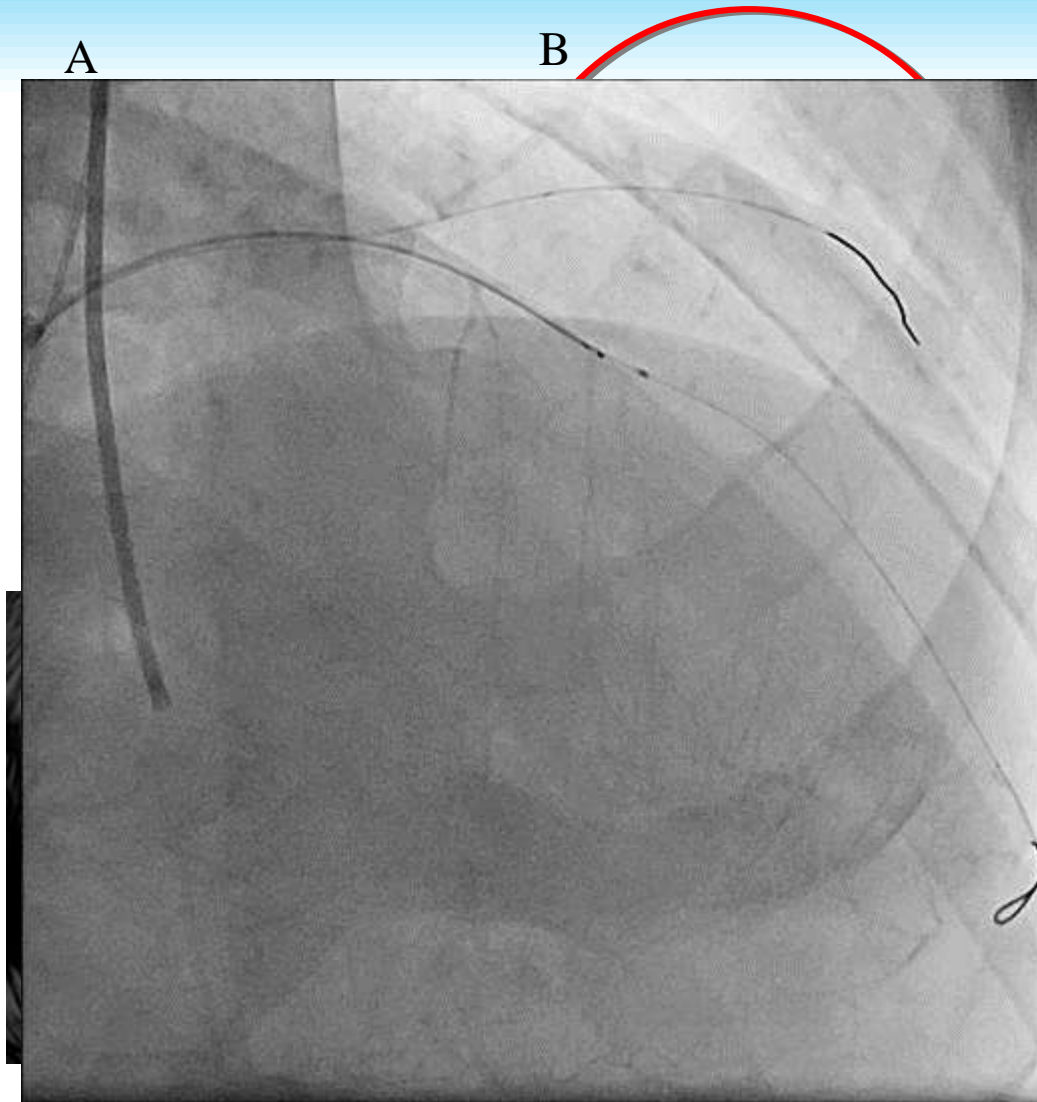
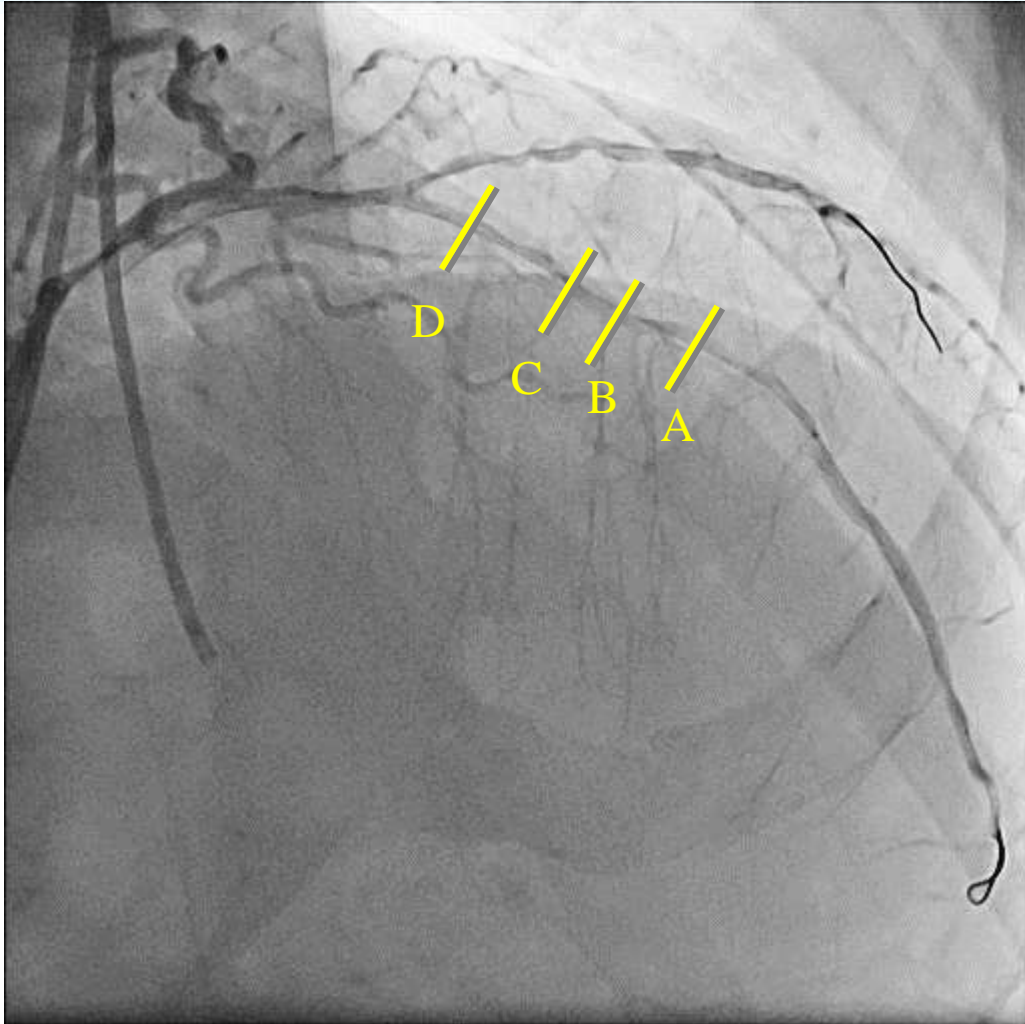


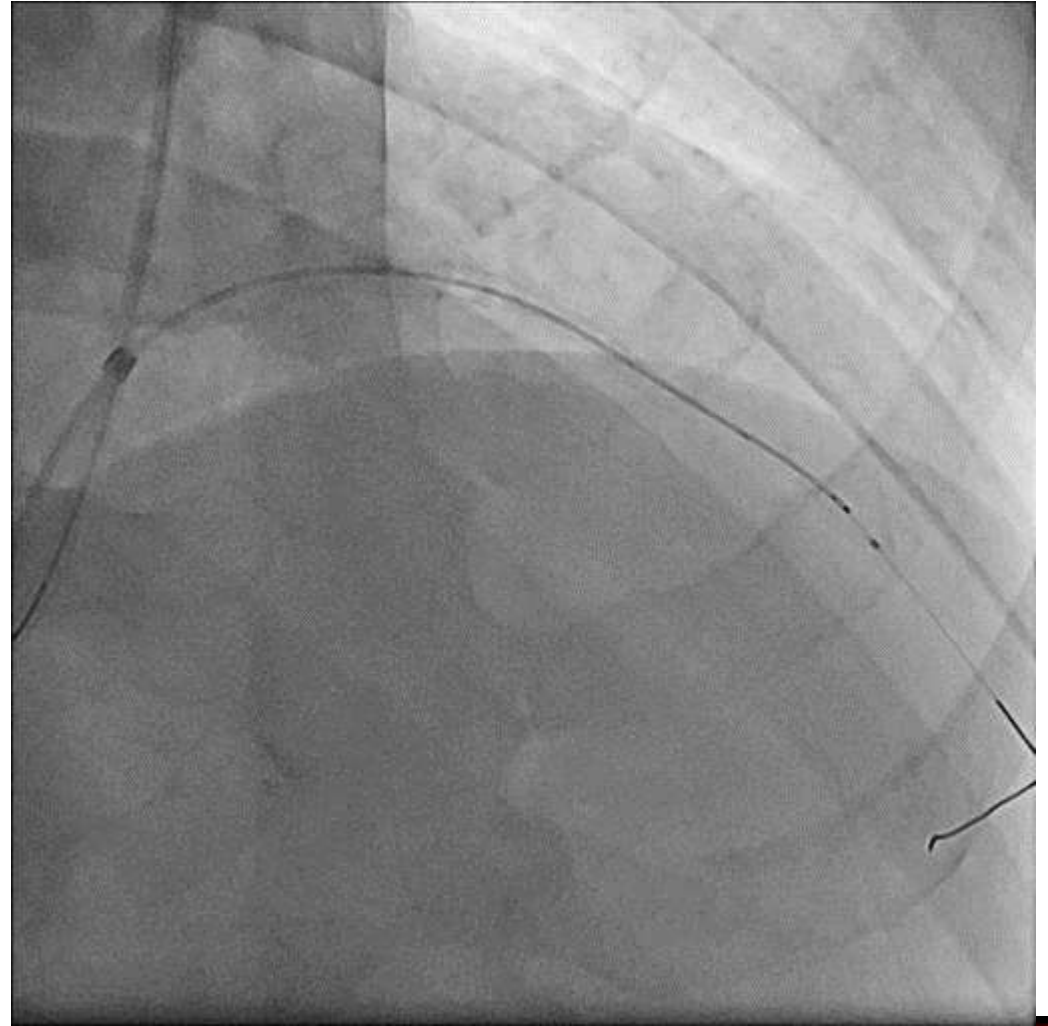
Case: LAD-CTO

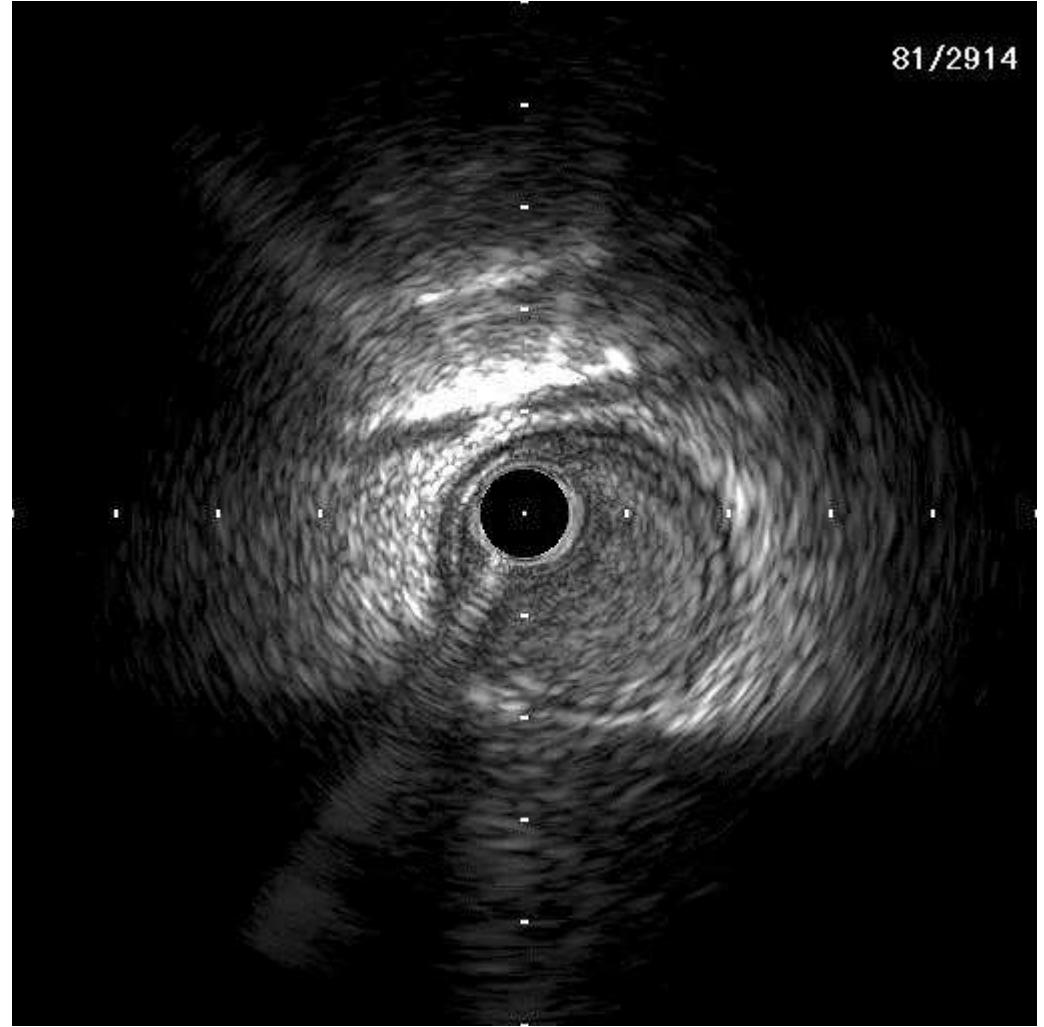
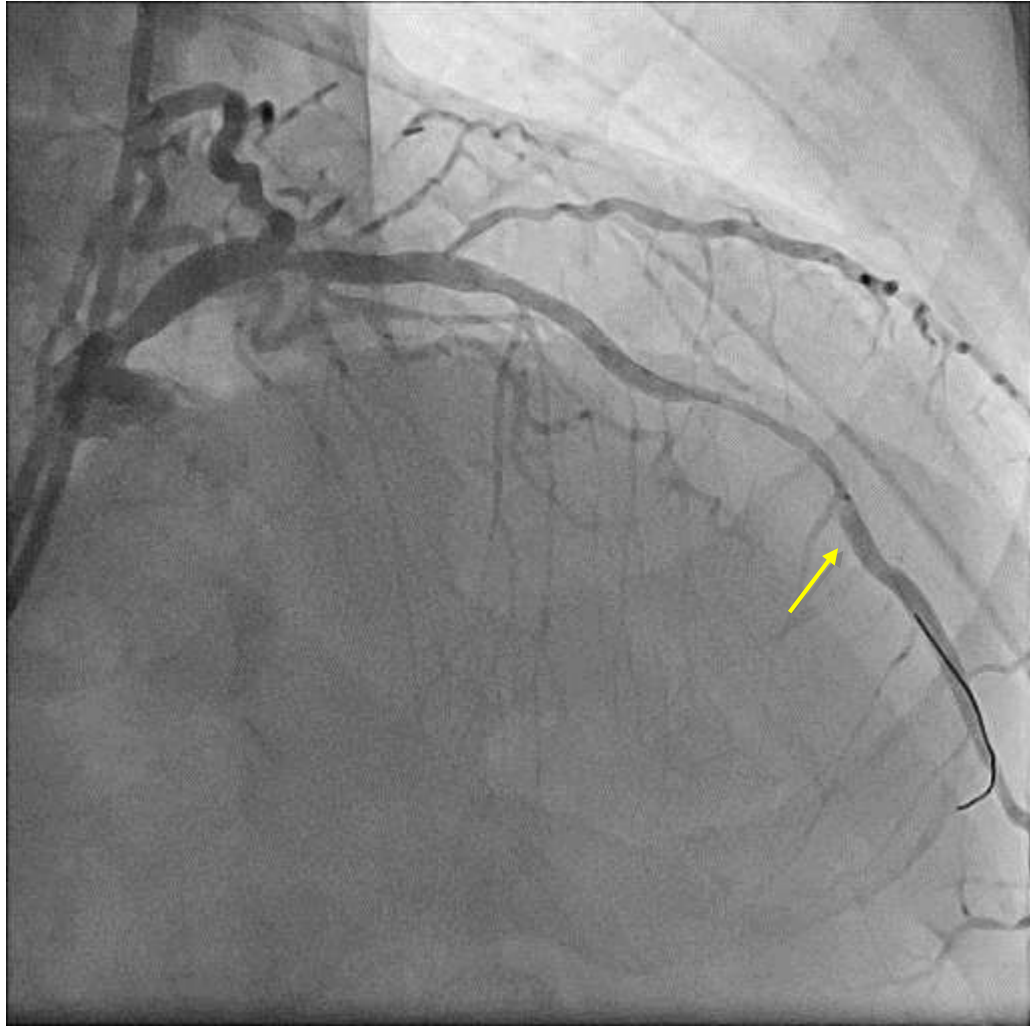


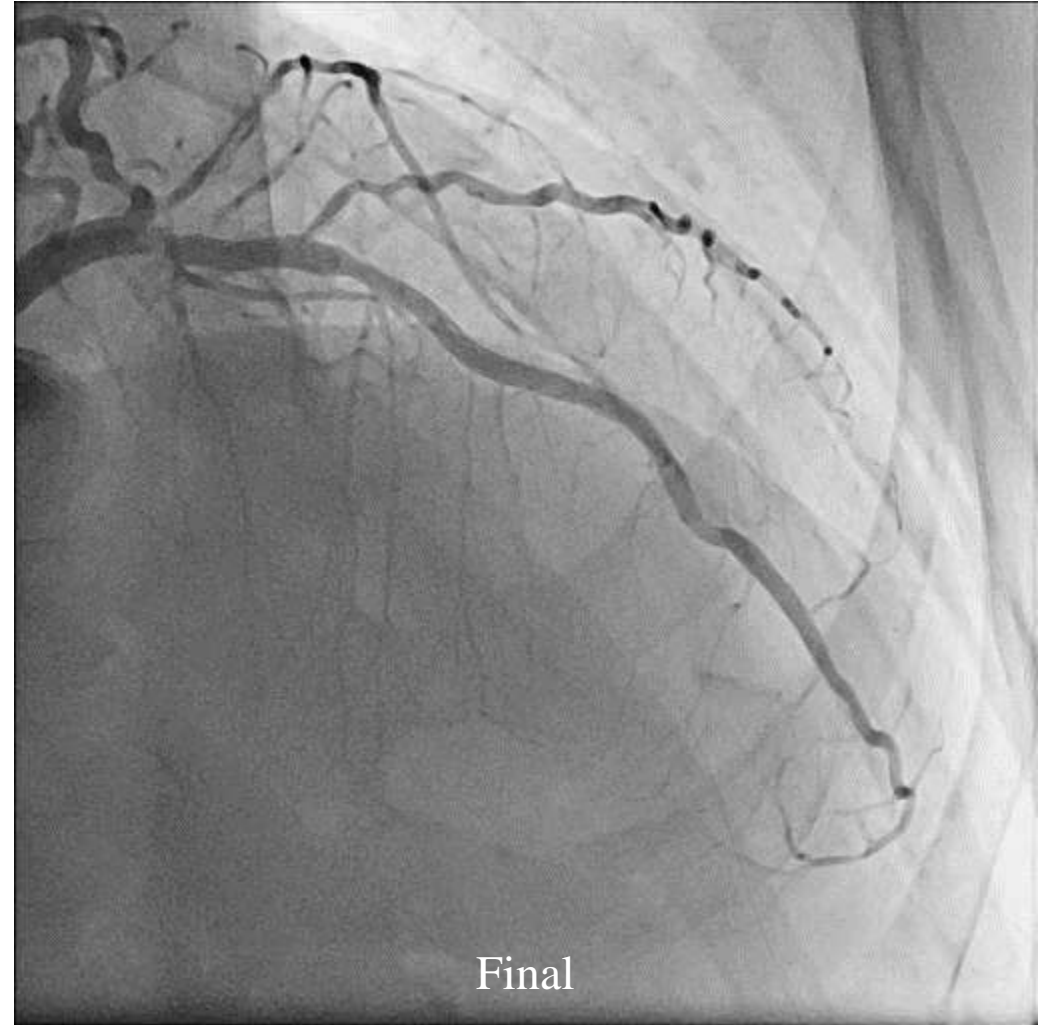


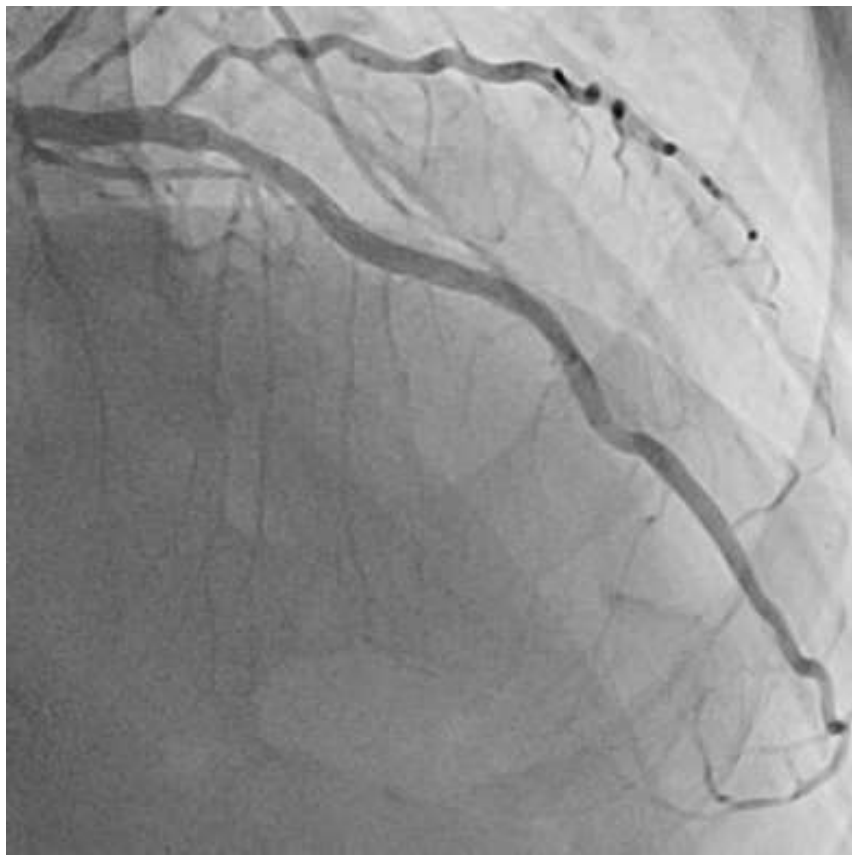
Where is optimal distal stenting site ?









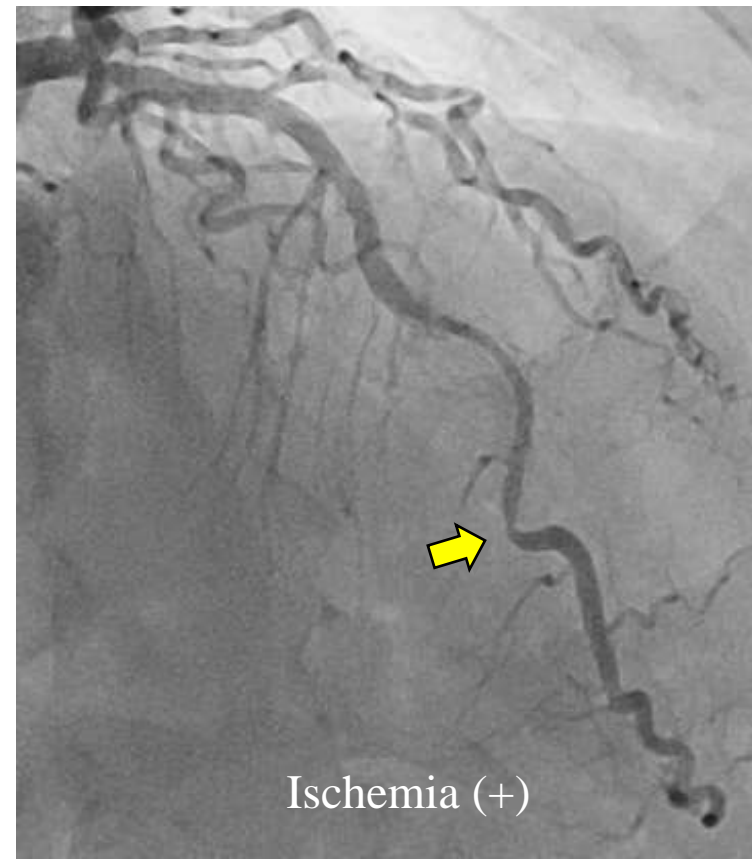


Final



Ischemia (+)

9months f/u → DCB3.0+3.5



Ischemia (+)

6 (15) months f/u



What is the factor which associated with TVR ?

Incidence and impact on midterm outcome of intimal versus subintimal tracking with both antegrade and retrograde approaches in patients with successful recanalisation of chronic total occlusions: J-PROCTOR 2 study

Katsuyuki Hasegawa, M.D et.al. EuroIntervention 2017;12:1868-1873

Table 1. Procedural results - antegrade vs. retrograde.

	Antegrade n=242	Retrograde n=81	p-value
Retrograde CTO crossing technique			
Reverse CART	-	44 (54.3%)	
Retrograde wire crossing	-	32 (39.5%)	
Kissing wire technique	-	4 (4.9%)	
CART	-	1 (1.2%)	
PCI procedure			
IVUS-guided wiring	12 (5.0%)	41 (50.6%)	<0.0001
Number of guidewires	3.2±2.0	4.6±2.2	<0.0001
Number of stents	1.9±0.8	2.3±0.8	<0.0001
Maximum stent diameter, mm	2.88±0.38	2.92±0.40	0.1
Stent length, mm	27.6±7.5	30.4±7.1	<0.0001
Maximum stent expansion pressure, atm	17.8±3.8	17.1±4.0	0.36

Table 3. Lesion characteristics and procedural results - retrograde group (intimal vs. subintimal).

	Intimal n=56	Subintimal n=25	p-value
Lesion characteristics			
Calcification	17 (30.4%)	12 (48.0%)	0.13
Proximal tortuosity	20 (35.7%)	11 (44.0%)	0.48
Bending (>45 degrees)	3 (5.4%)	5 (20.0%)	0.06
Occlusion length (>20 mm)	31 (55.4%)	15 (60.0%)	0.7
Reference diameter (<3.0 mm)	35 (62.5%)	18 (72.0%)	0.41
Reattempt	15 (26.8%)	6 (24.0%)	0.79
Bridge collateral	44 (78.6%)	18 (72.0%)	0.52
Procedural results			
Reattempt	22 (39.3%)	19 (76.0%)	0.002
Stent length, mm	4.1±1.8	5.9±2.6	0.003
Stent length, mm	1.7±0.7	1.8±0.8	0.03
Maximum stent diameter, mm	2.9±0.3	2.9±0.3	0.21
Stent length, mm	59.7±24.4	74.0±24.4	0.02
Maximum stent expansion pressure, atm	17.1±4.2	17.1±3.8	0.99

Table 4. MACE at 12 months.

A. Antegrade vs. retrograde	Antegrade n=242	Retrograde n=81	p-value
MACE	3.7% (9)	12.3% (10)	0.007
TVR	2.9% (7)	9.9% (8)	0.02
MI	0% (0)	1.2% (1)	0.25
Cardiac death	0% (0)	1.2% (1)	0.25
Non-cardiac death	0.8% (2)	1.2% (1)	>0.99
SAT/LT	0% (0)	1.2% (1)	0.25
B. Intimal vs. subintimal	Intimal n=270	Subintimal n=107	p-value
MACE	4.8% (13)	4.4% (4)	0.87
TVR	3.7% (10)	9.4% (5)	0.08
MI	0.4% (1)	0% (0)	0.84
Cardiac death	0% (0)	1.9% (1)	0.16
Non-cardiac death	1.1% (3)	0% (0)	0.58
SAT/LT	0.4% (1)	0% (0)	0.84

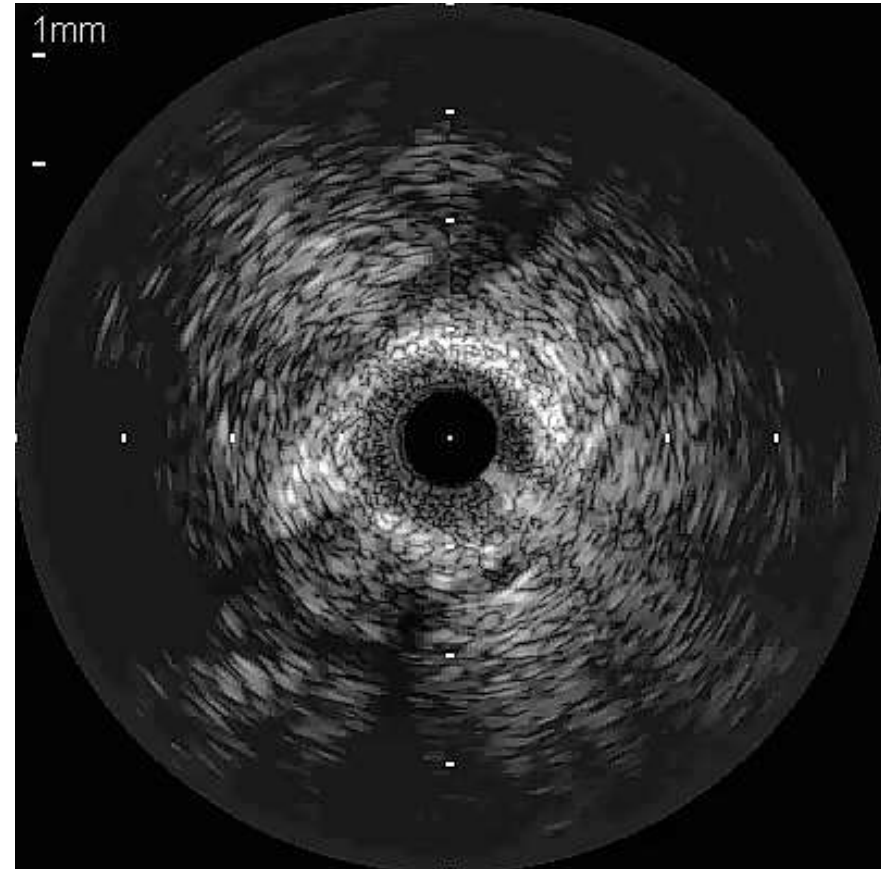
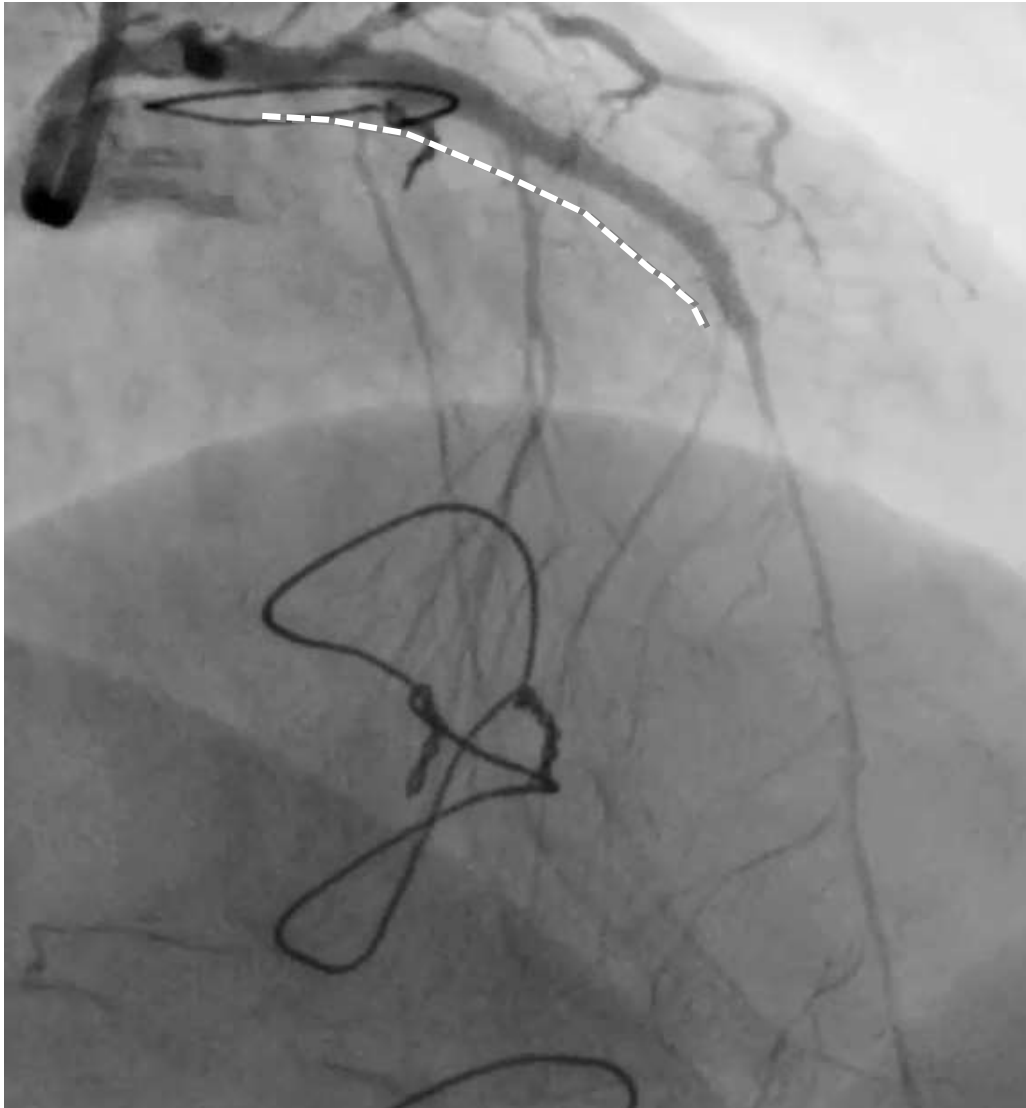
LT: late thrombosis; SAT: subacute thrombosis

Avoid full metal jack or long stenting

	Antegrade n=242	Retrograde n=81	p-value
PCI procedure			
IVUS-guided wiring	31 (11.5%)	22 (41.5%)	<0.0001
Number of guidewires	2.9±1.8	4.5±2.8	<0.0001
Number of stents	1.8±0.8	2.±0.8	0.002
Maximum stent diameter, mm	2.9±0.3	2.8±0.3	0.17
Stent length, mm	49.2±22.9	62.5±27.0	<0.0001
Maximum stent expansion pressure, atm	17.5±3.9	17.3±4.0	0.71



Case: LAD CTO (Post Stenting)

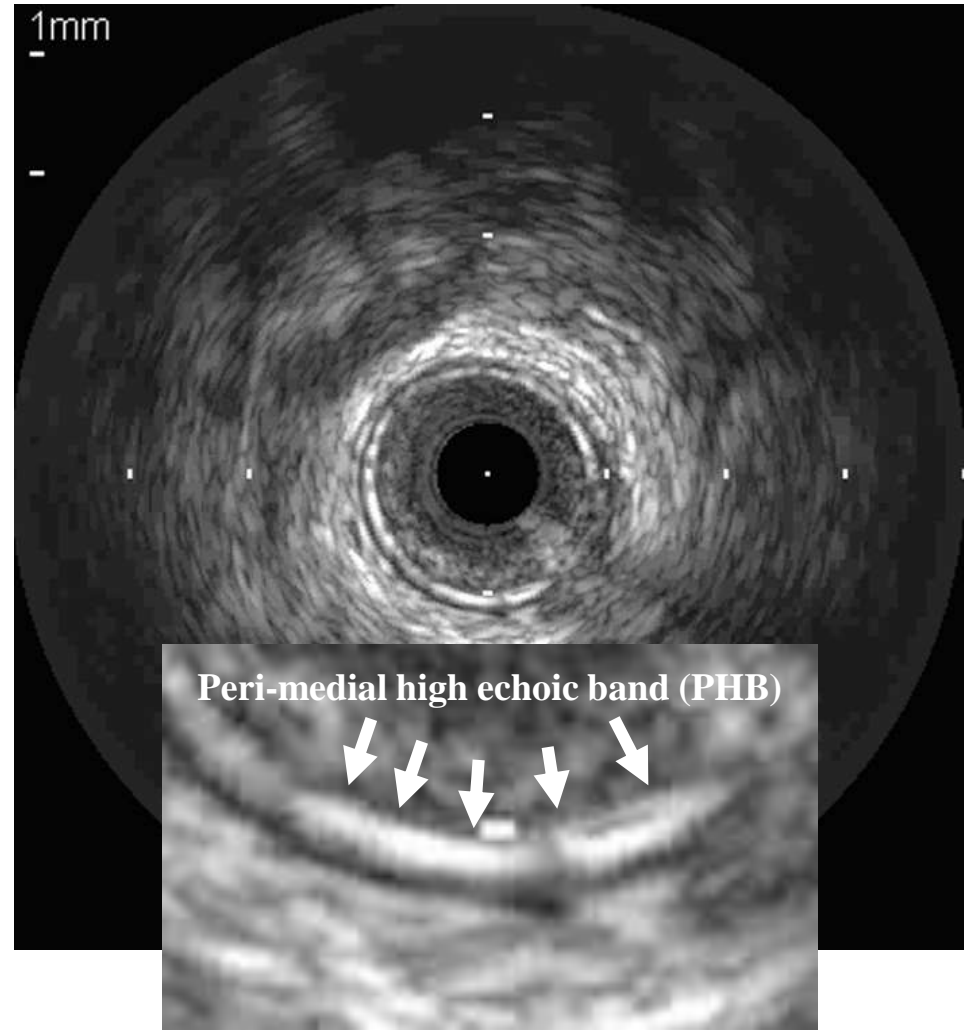
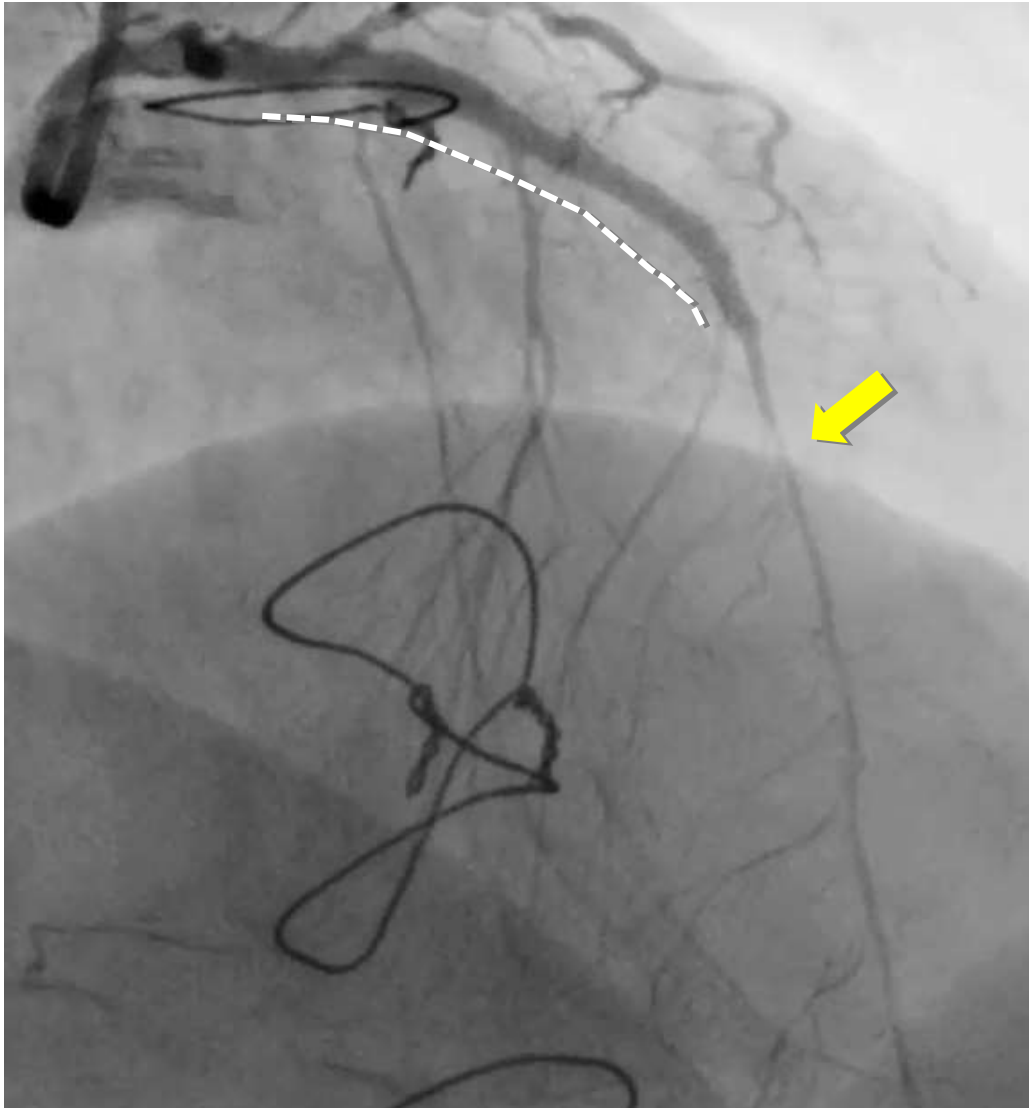


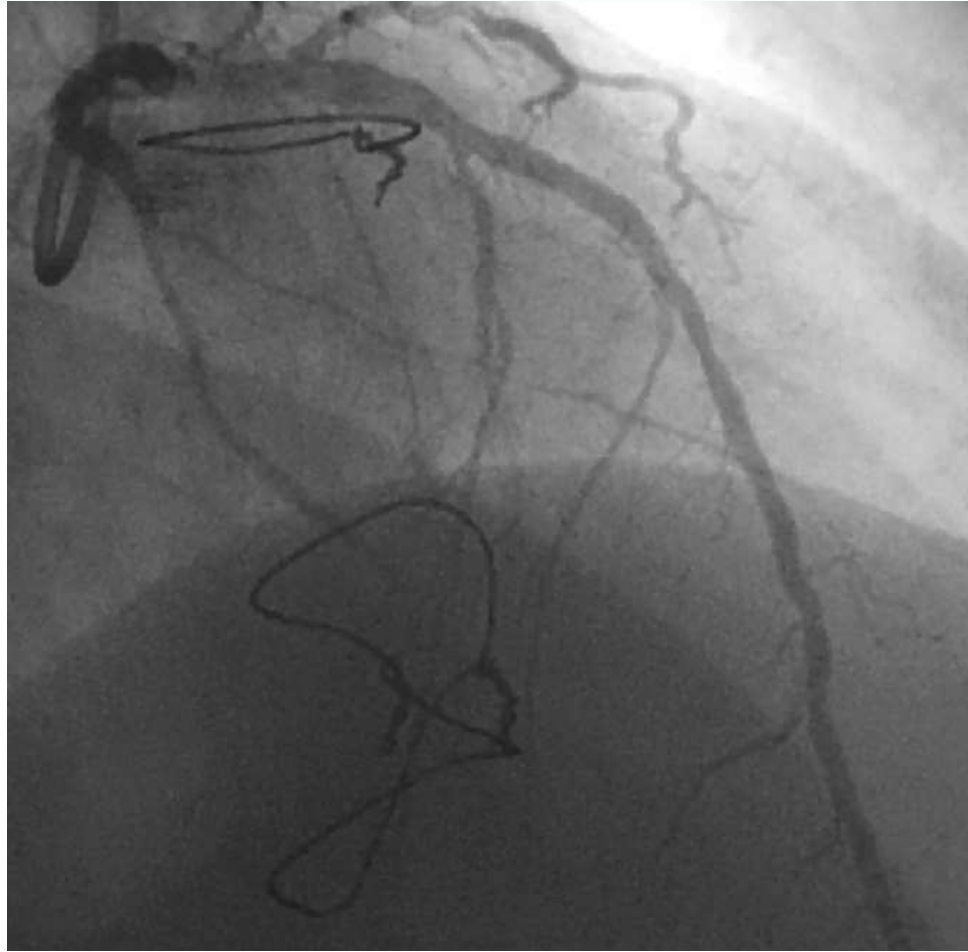
By courtesy of Dr Okura H



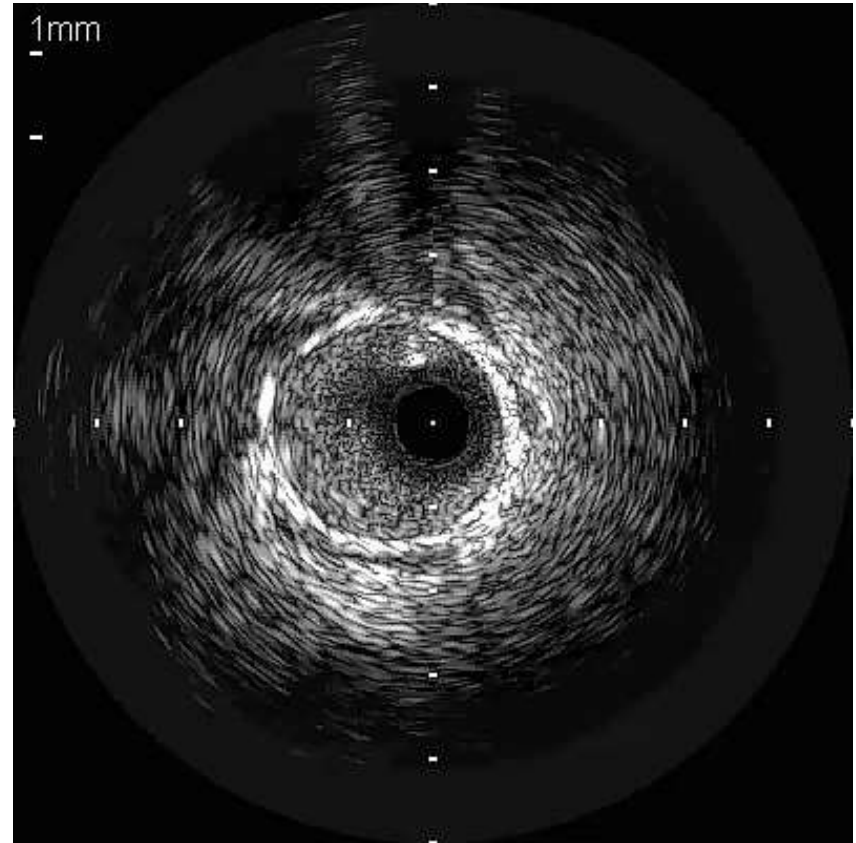
Toyohashi Heart Center







9 months follow up

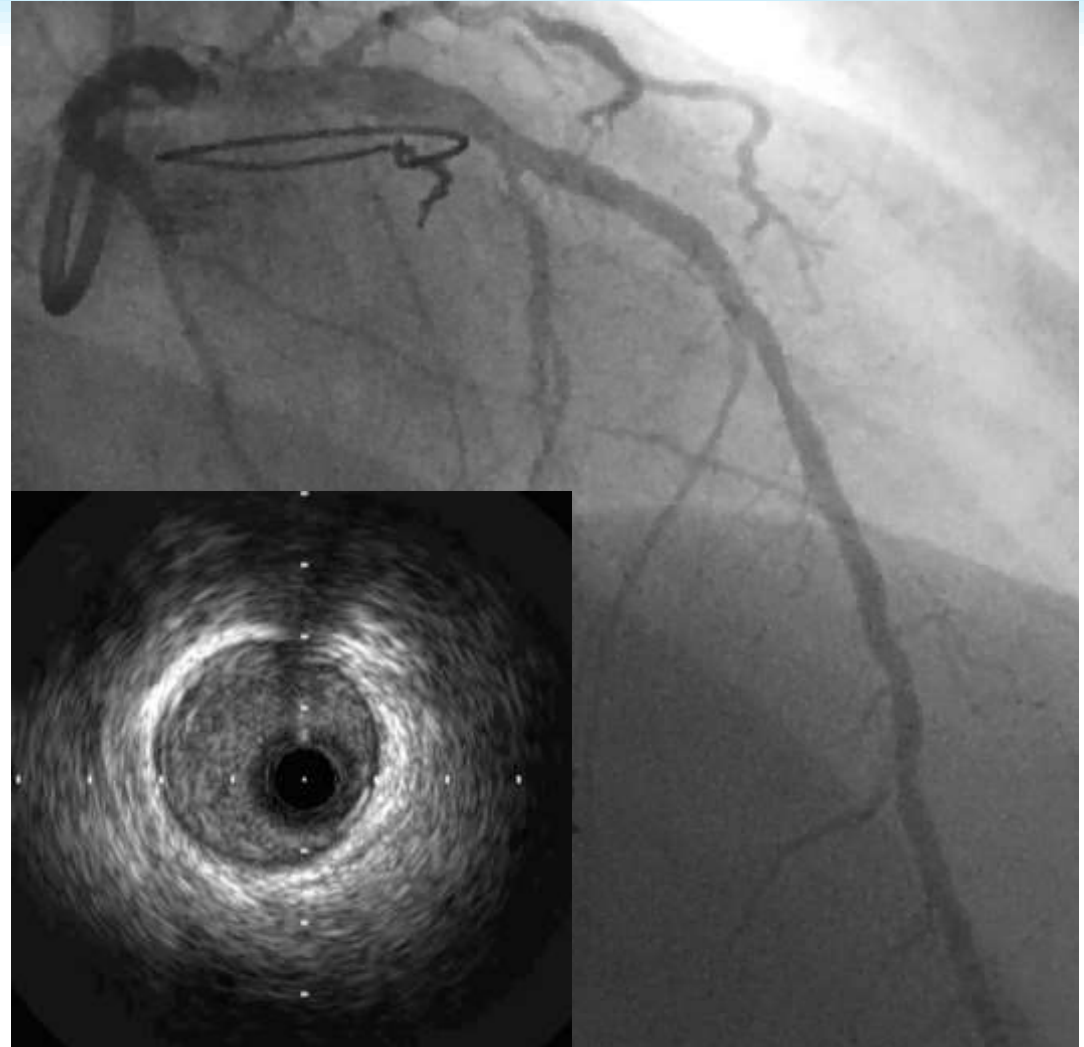
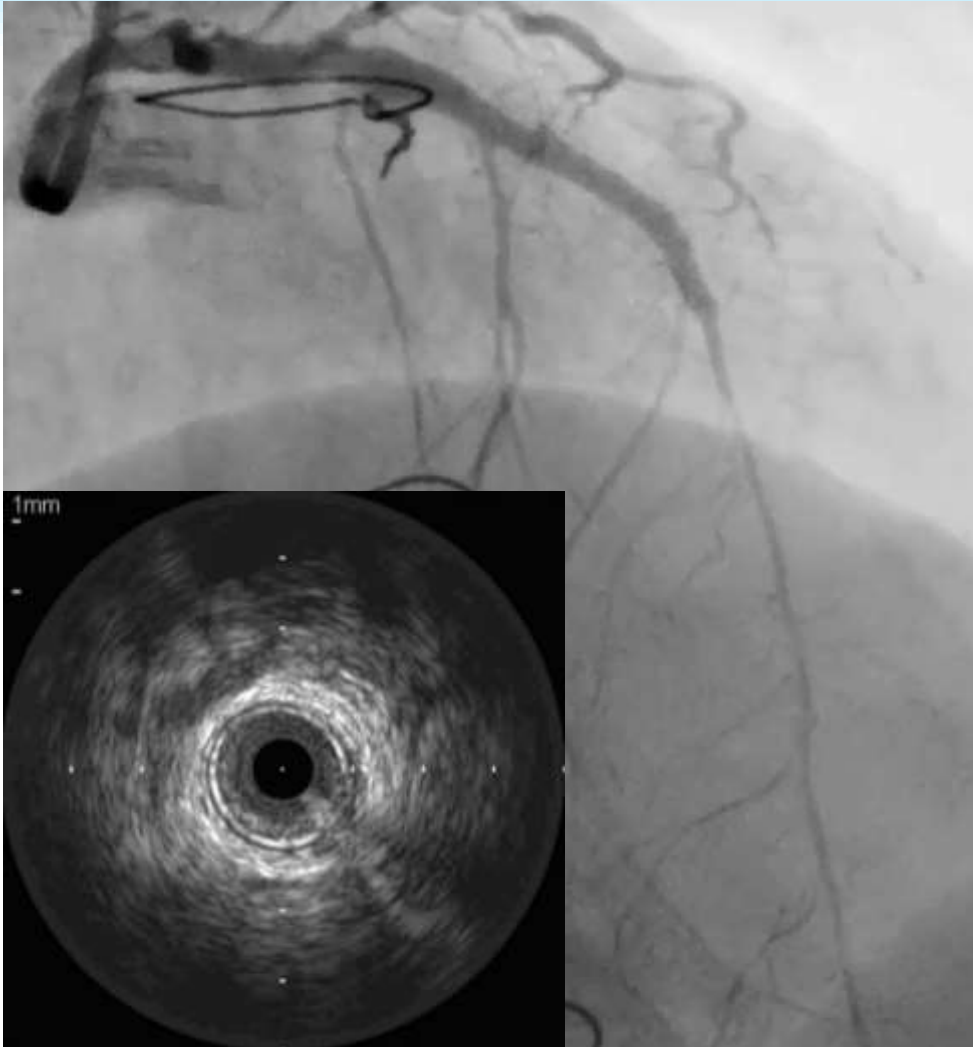


By courtesy of Dr Okura H



Toyohashi Heart Center





By courtesy of Dr Okura H

Toyohashi Heart Center



Why vessel was enlarged at follow up ?

Prediction of Chronic Vessel Enlargement by a Novel Intravascular Ultrasound Finding

– Peri-Medial High-Echoic Band –

Circ J 2015;79:607-612
Neishi Y, M.D. Okura H, M.D. et.al.

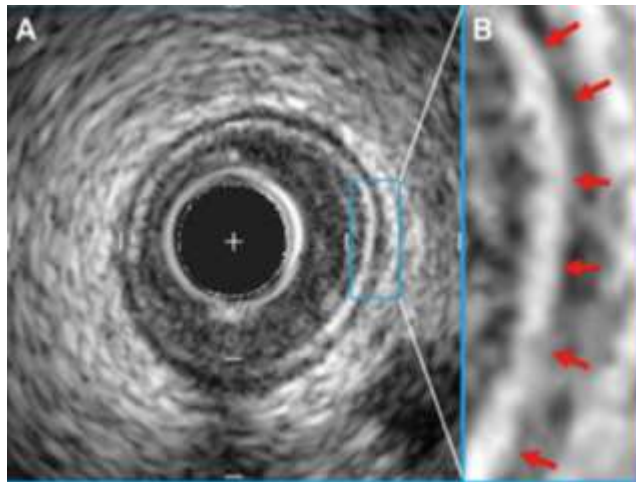


Table 4. IVUS Comparison of Lesions With and Without LLG in Patients Who Underwent Successful IVUS-Guided PCI for Severe Coronary Stenosis

	LLG (+) (n=16)	LLG (-) (n=11)	P value
EEM CSA, mm ²	7.8±4.6	9.9±4.7	0.292
Lumen CSA, mm ²	4.1±1.8	6.7±3.4	0.071
P+M CSA, mm ²	3.8±3.2	3.2±1.5	0.845
Plaque burden, %	43±15	33±10	0.082
PHB, n (%)	14 (88)	2 (18)	0.007

LLG, late lumen gain. Other abbreviations as in Tables 1,3.

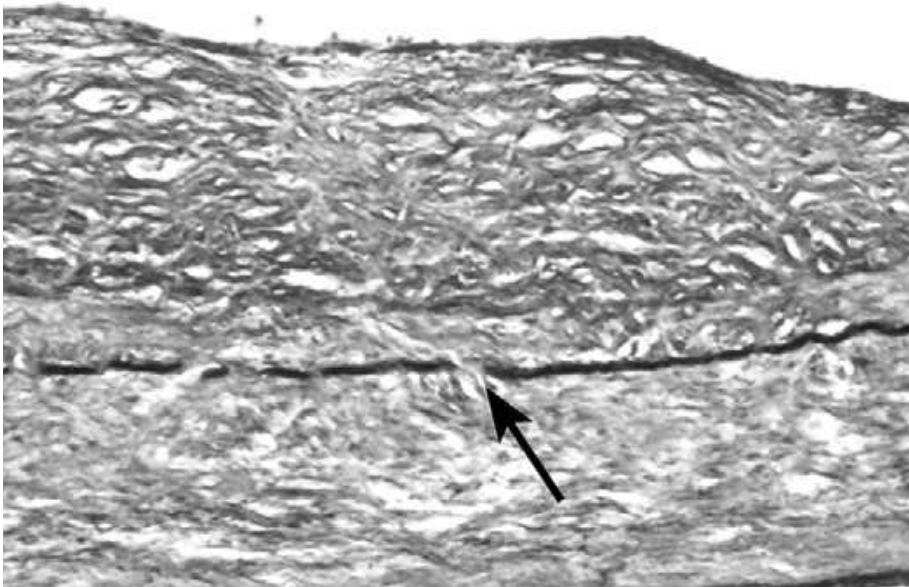
By courtesy of Dr Okura H

enter

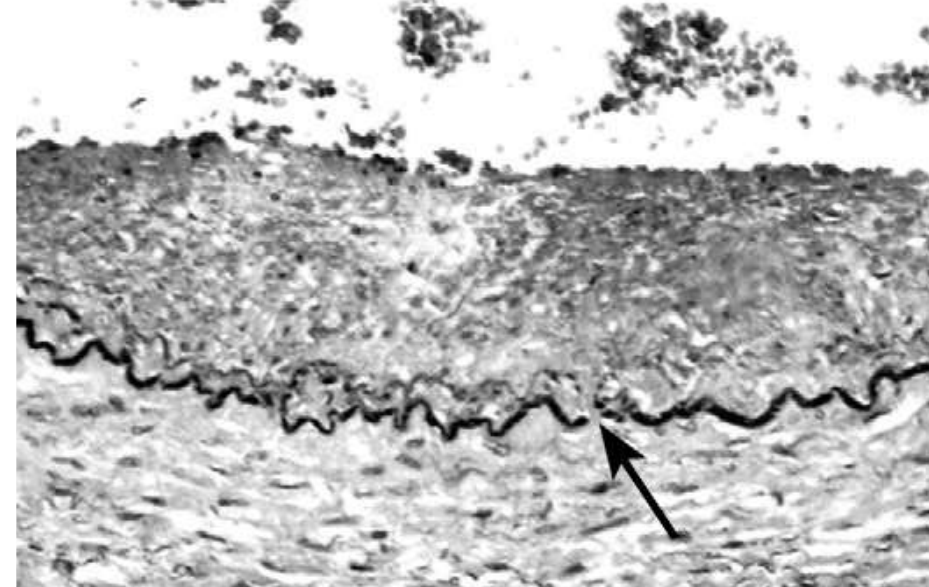


Medial thickening and folding of the Internal elastic membrane during coronary spasm

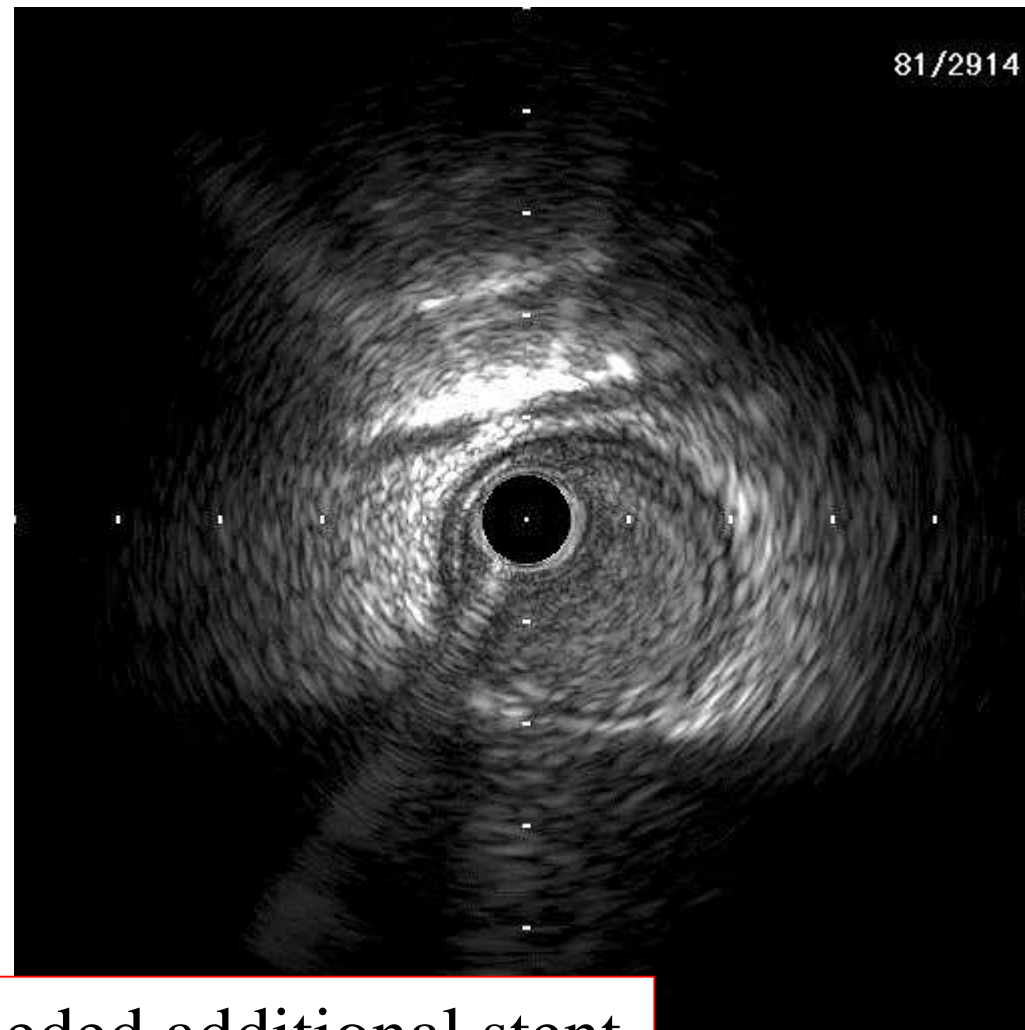
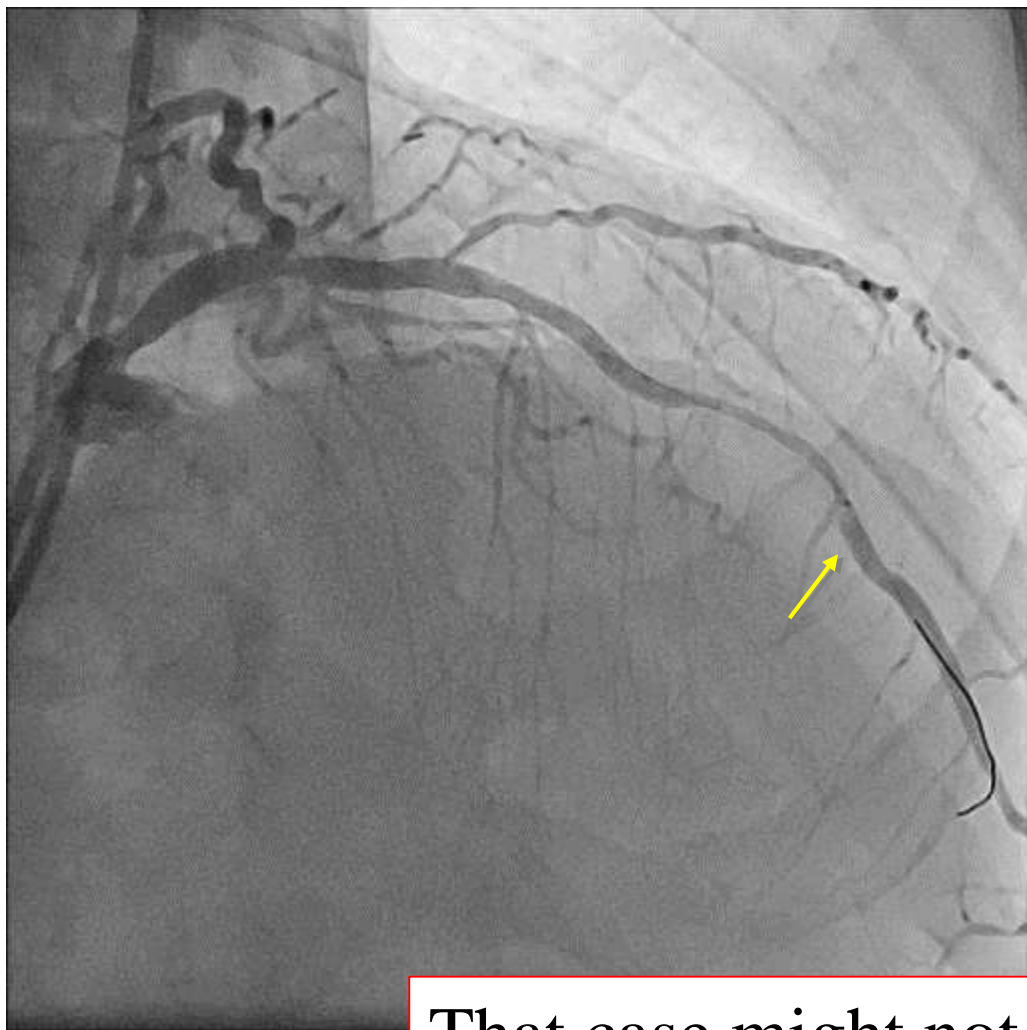
Spasm (-)



Spasm (+)

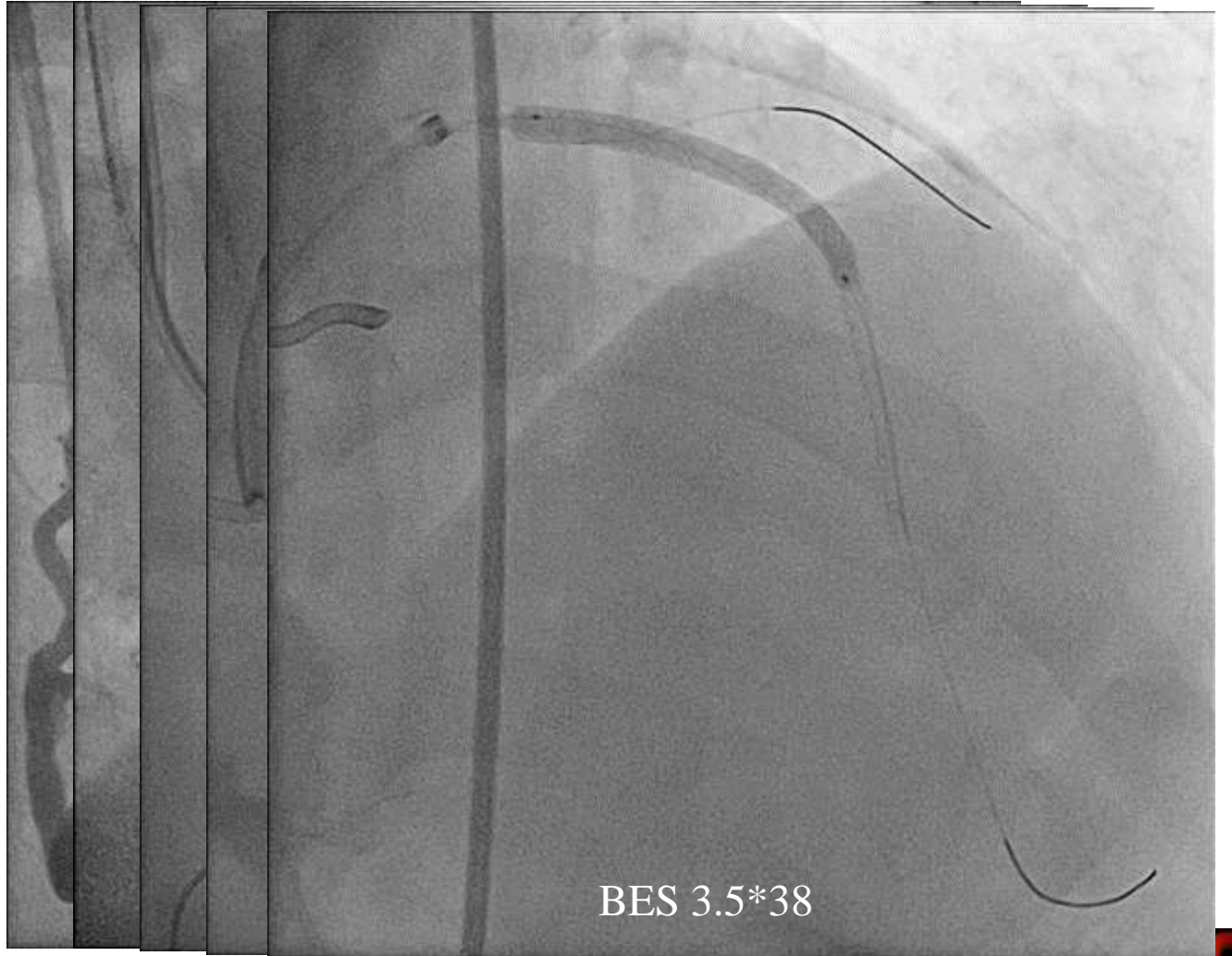
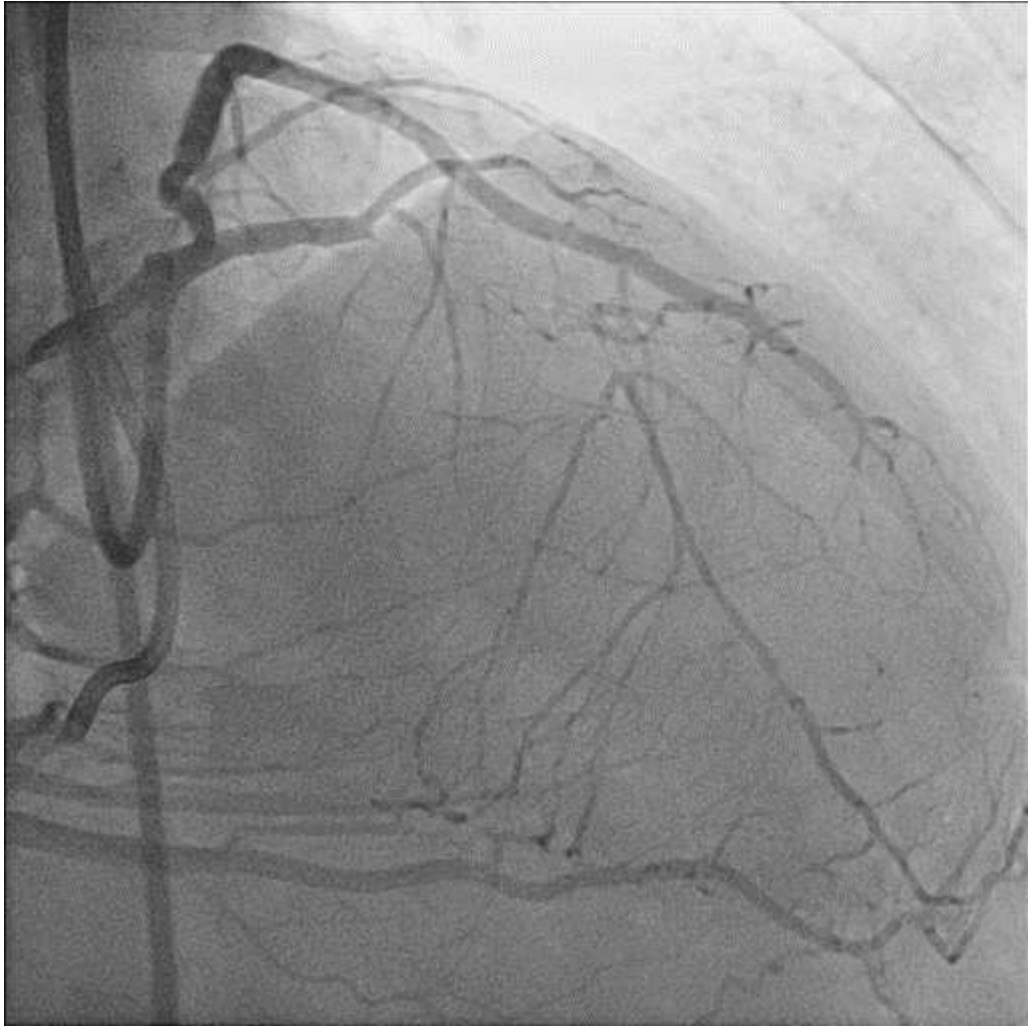


Review of previous case



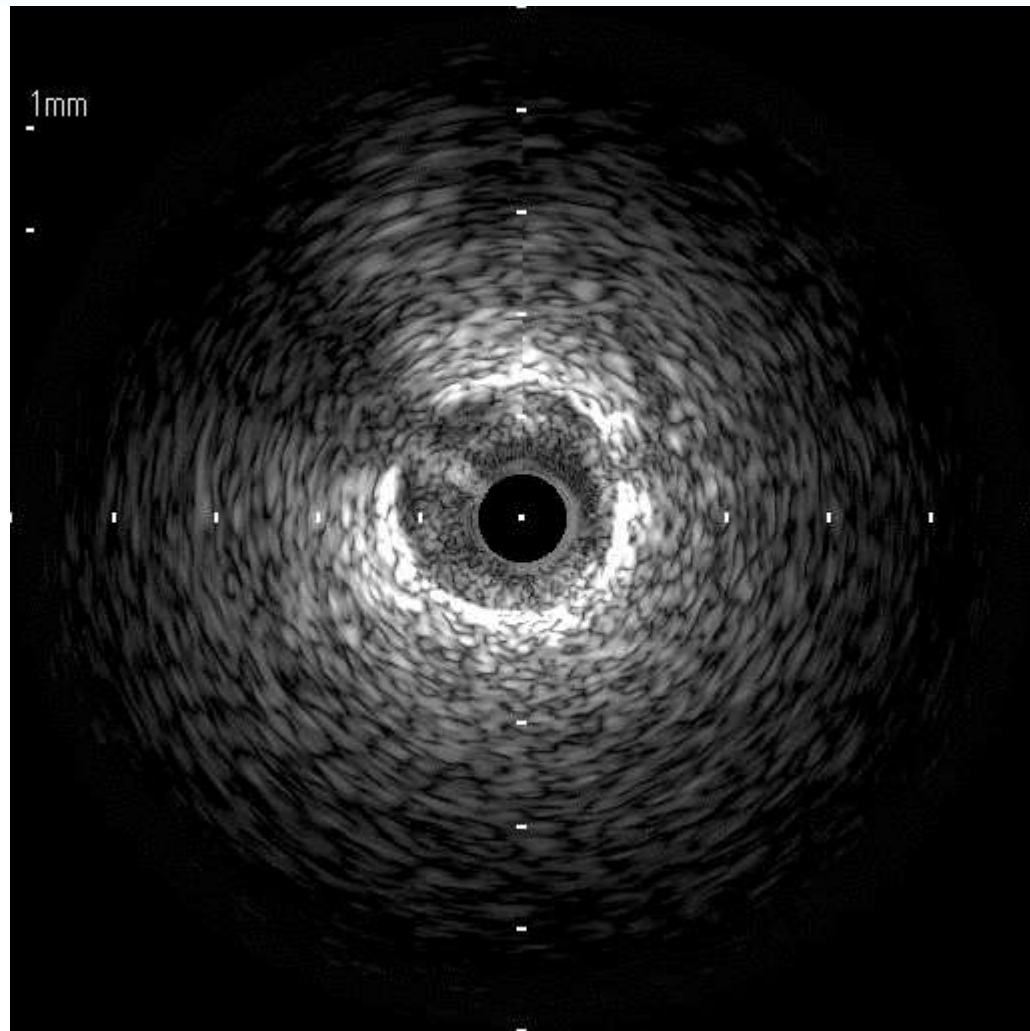
That case might not be needed additional stent

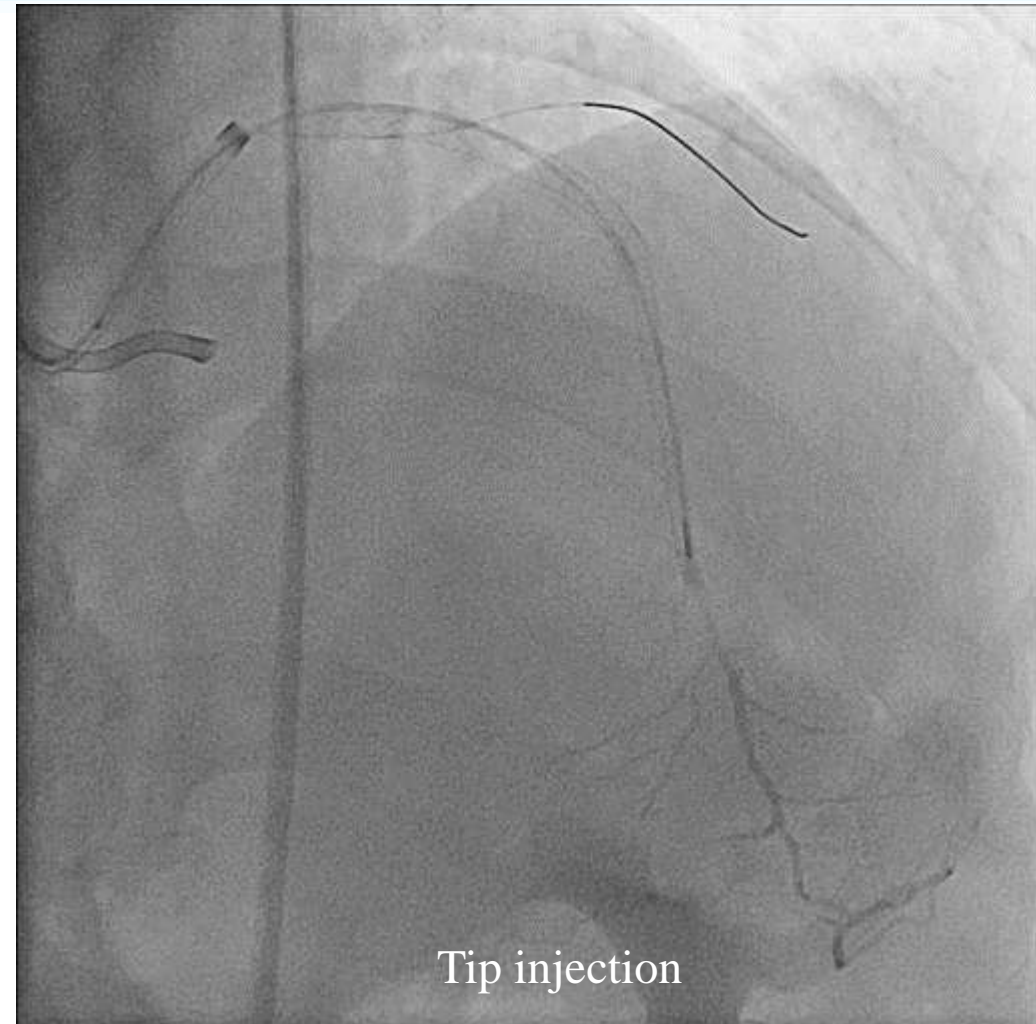
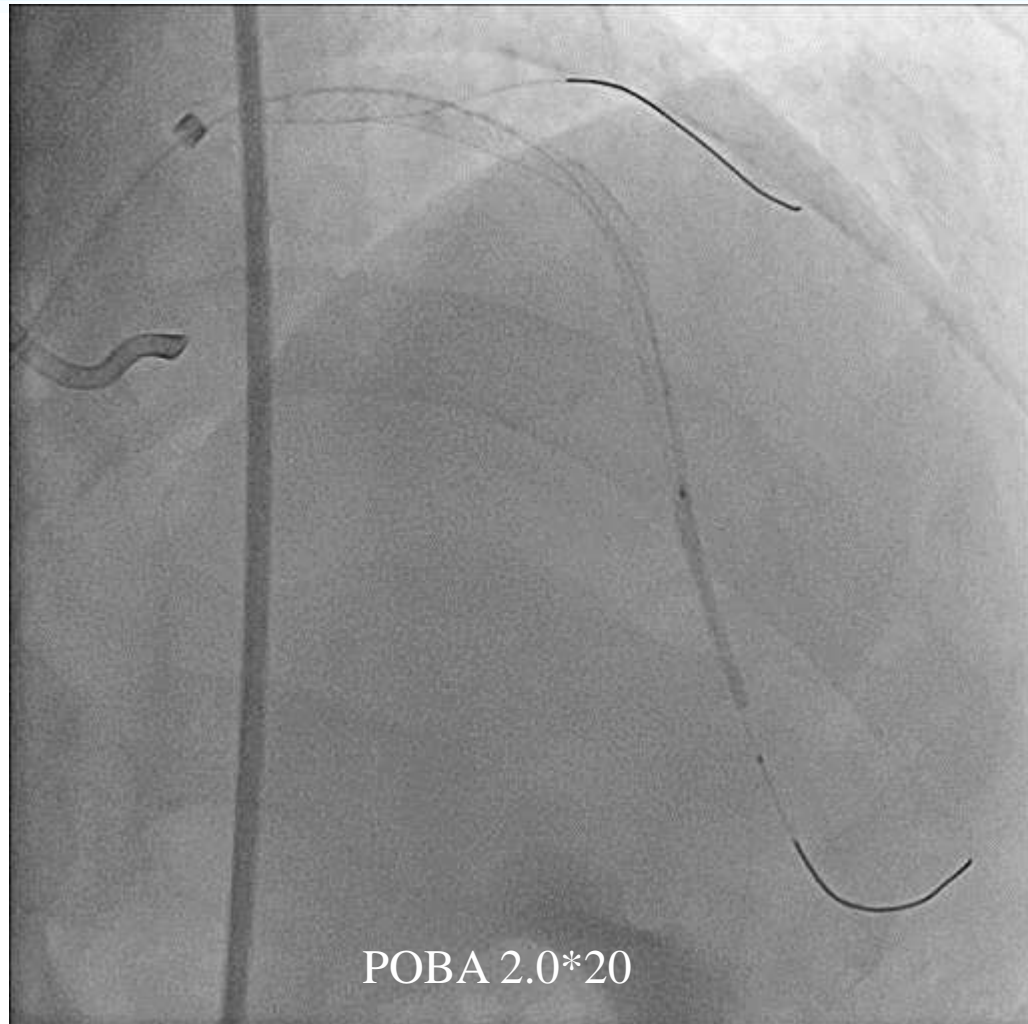


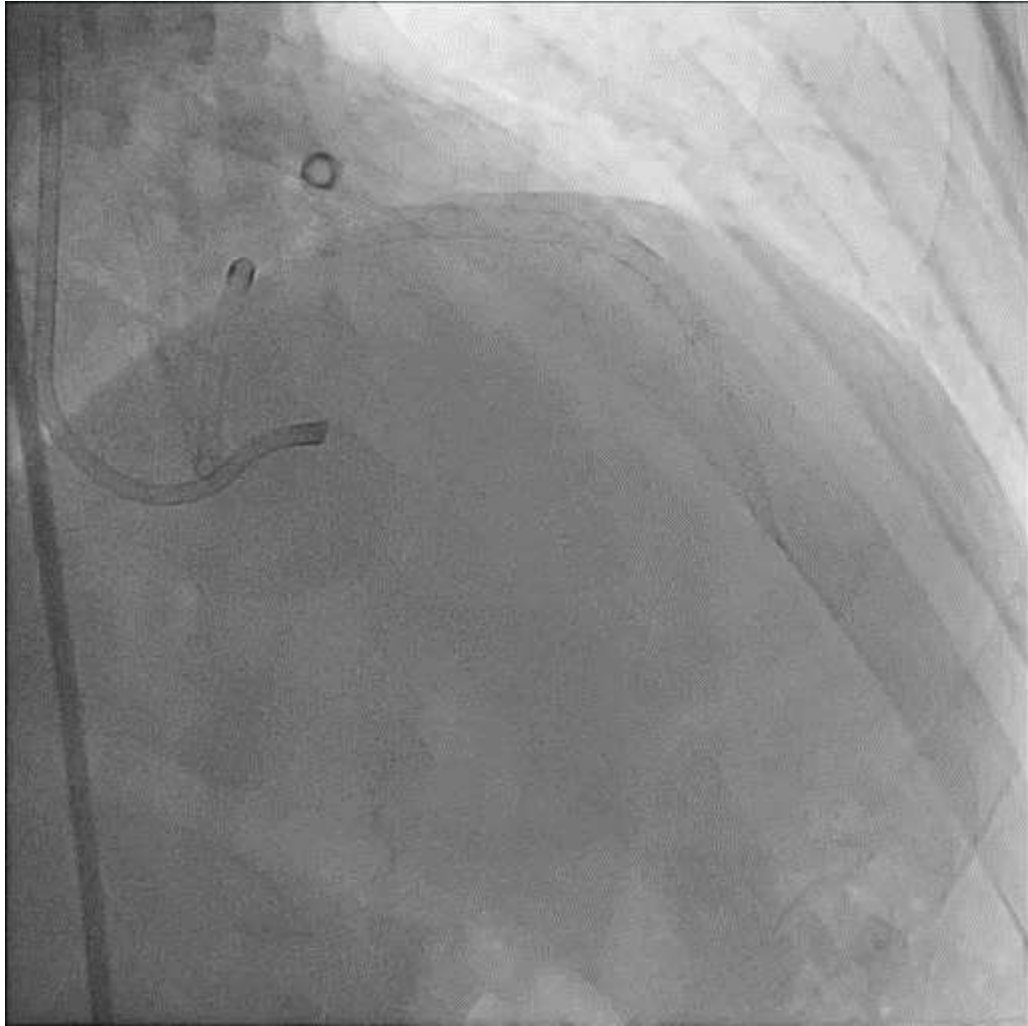


BES 3.5*38

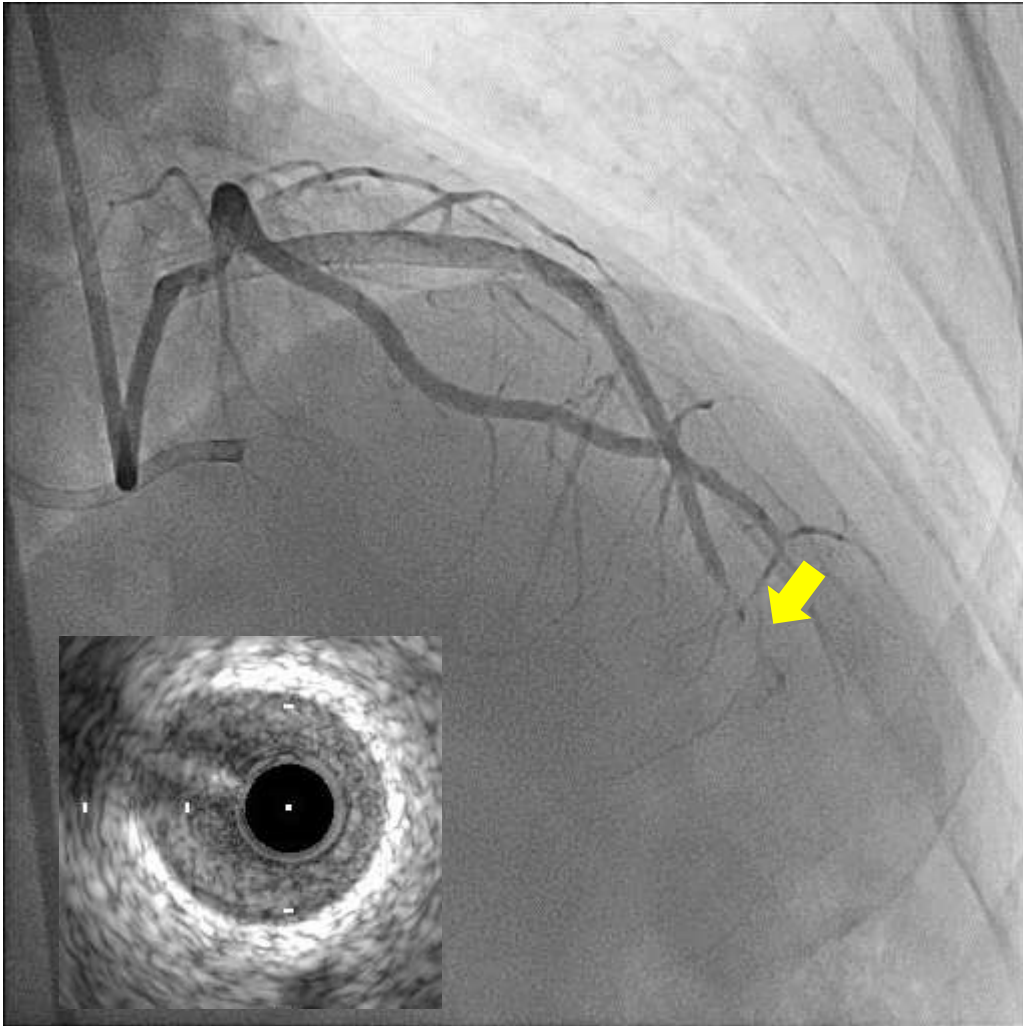








8 months f/u



Can we ignore all lesions with distal vessel narrowing?

Full Metal Jacket With Drug-Eluting Stents for Coronary Chronic Total Occlusion

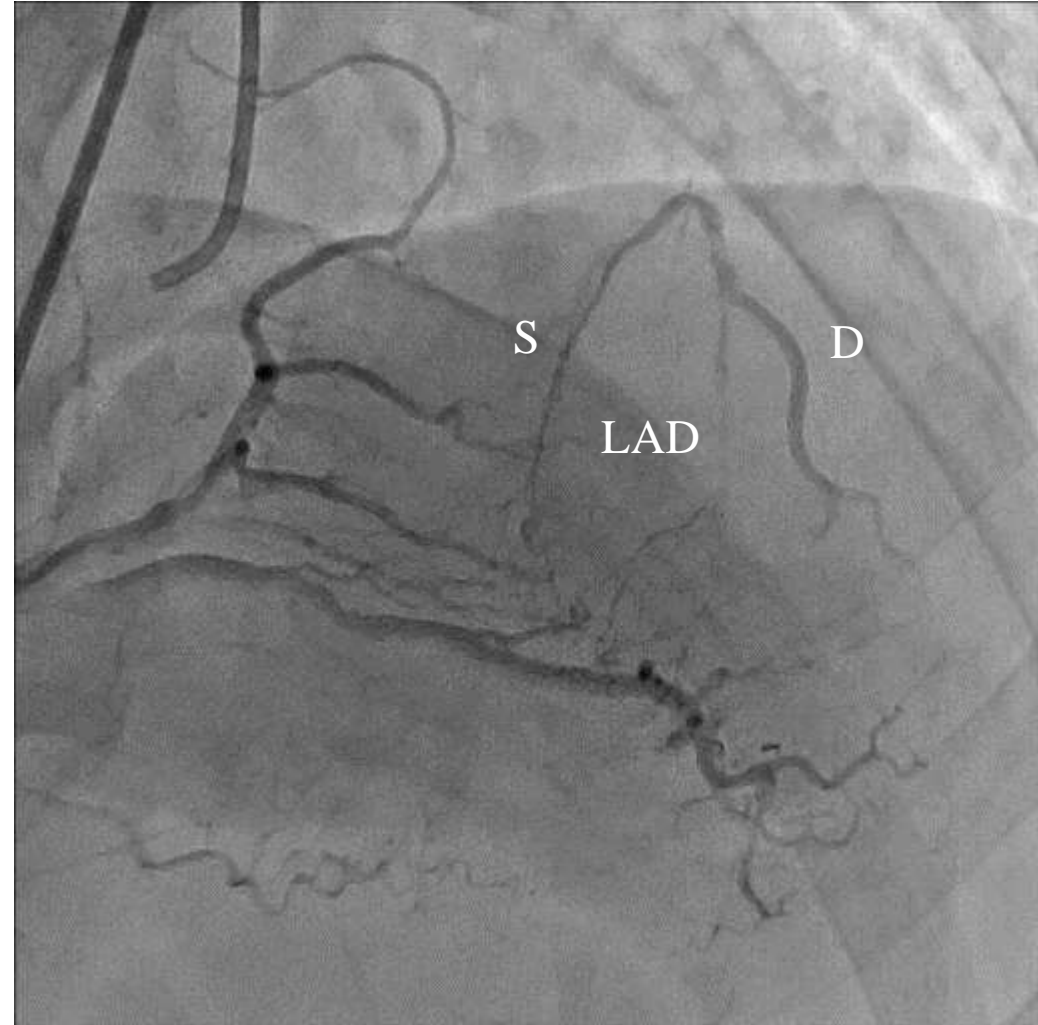
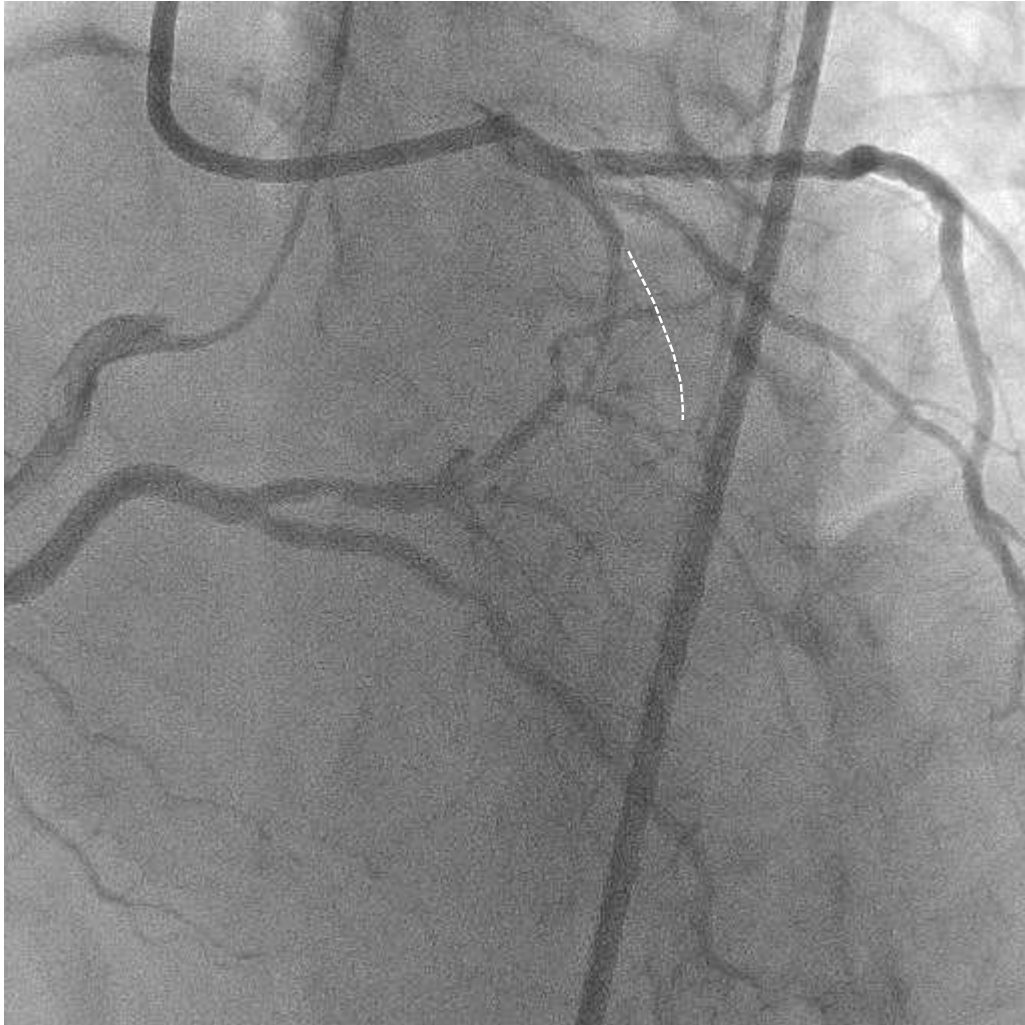
JACC interv:2017:10:1405-12

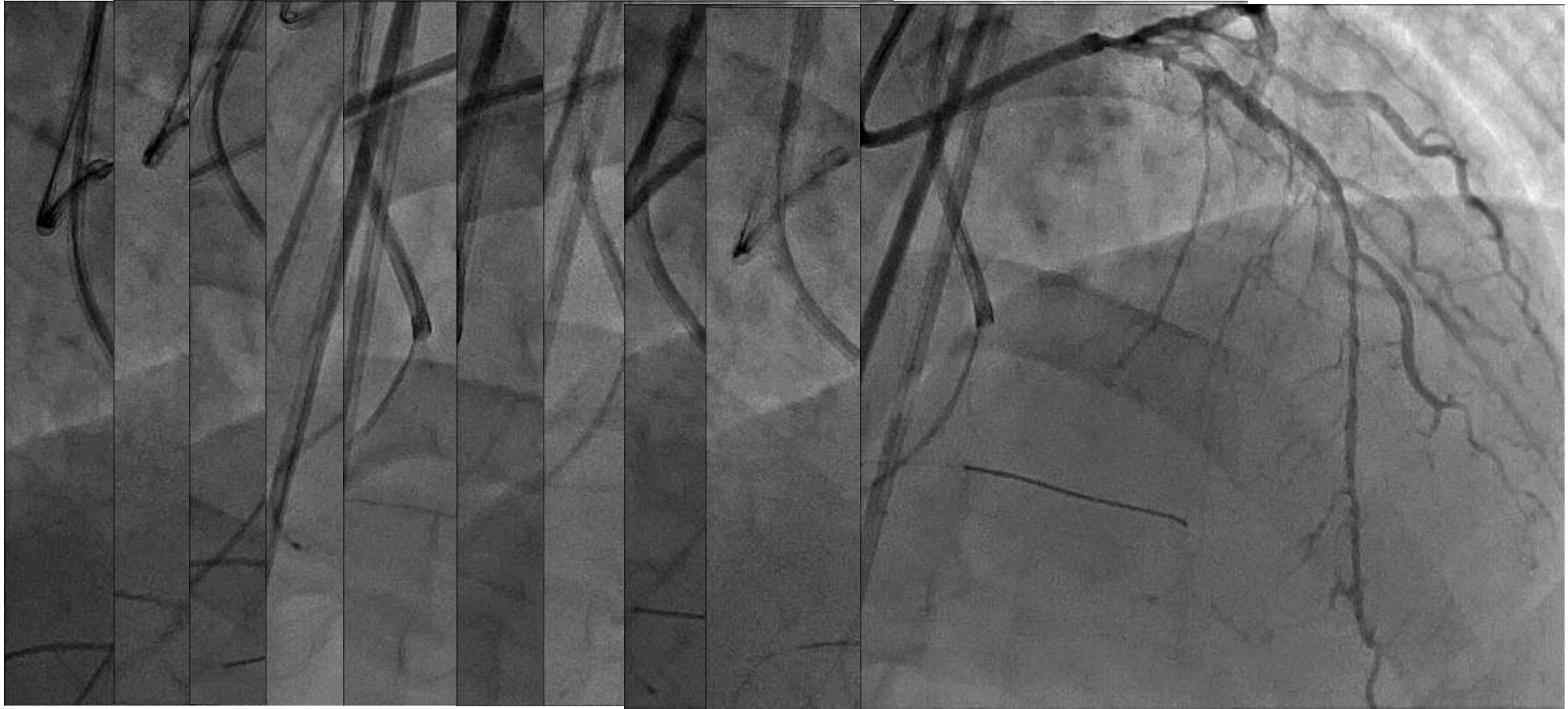
TABLE 4 Predictors of Target Lesion Failure

	Univariate	p Value	Multivariate	p Value
Diabetes mellitus	0.88 (0.53-1.47)	0.63	NA	
Left ventricular ejection fraction (per 1% increment)	0.99 (0.97-1.02)	0.66	NA	
J-CTO score (per 1-U increment)	1.00 (0.80-1.26)	0.98	NA	
Multiple CTOs	1.86 (0.95-3.64)	0.07	1.92 (0.98-3.78)	0.06
Repeat-attempt CTO PCI	1.07 (0.58-1.97)	0.83	NA	
<u>Stent number of the target vessel (per 1 increment)</u>	<u>1.52 (1.03-2.23)</u>	<u>0.03</u>	1.72 (1.16-2.54)	0.006
Average stent diameter (per 1-mm decrement)	1.20 (0.52-2.75)	0.67		
<u>Persistent distal luminal narrowing</u>	<u>2.51 (1.54-4.10)</u>	<u><0.001</u>	2.73 (1.66-4.47)	<0.001

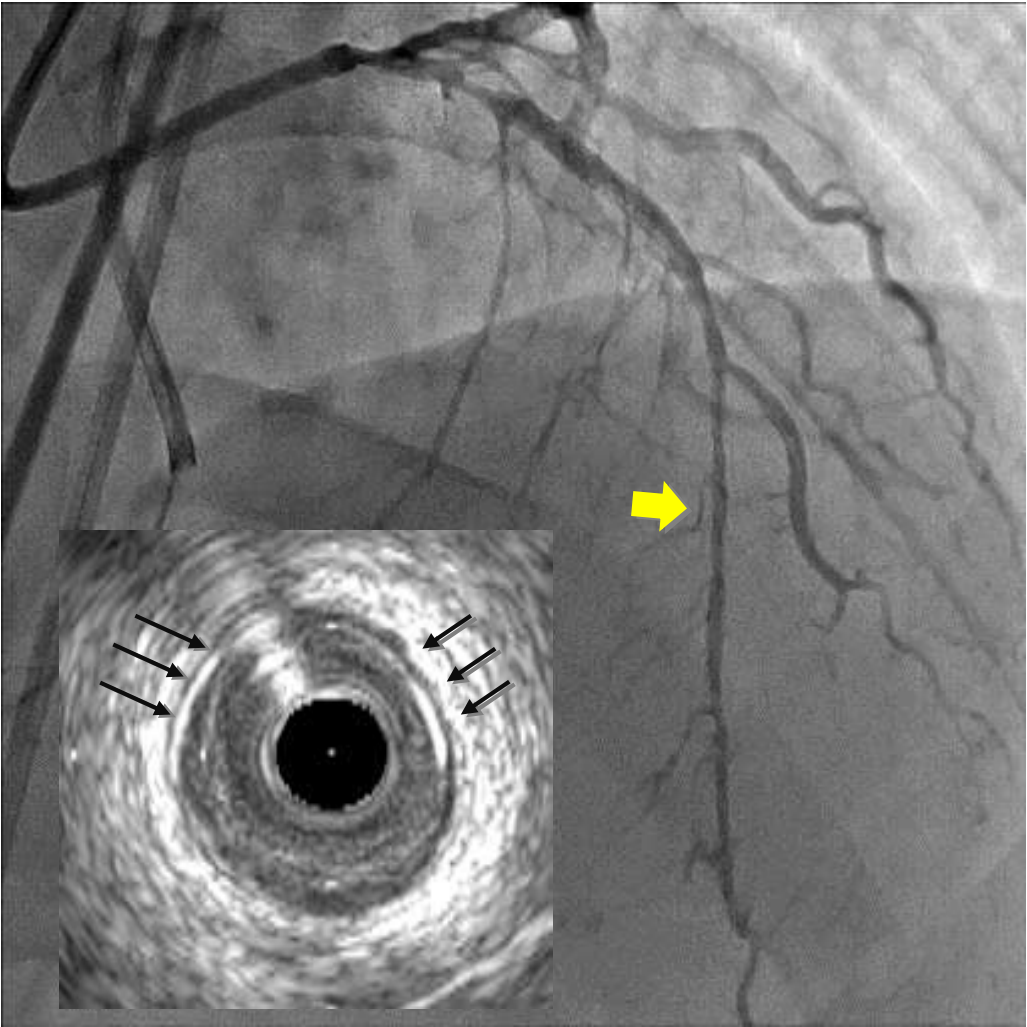


Case: LAD CTO

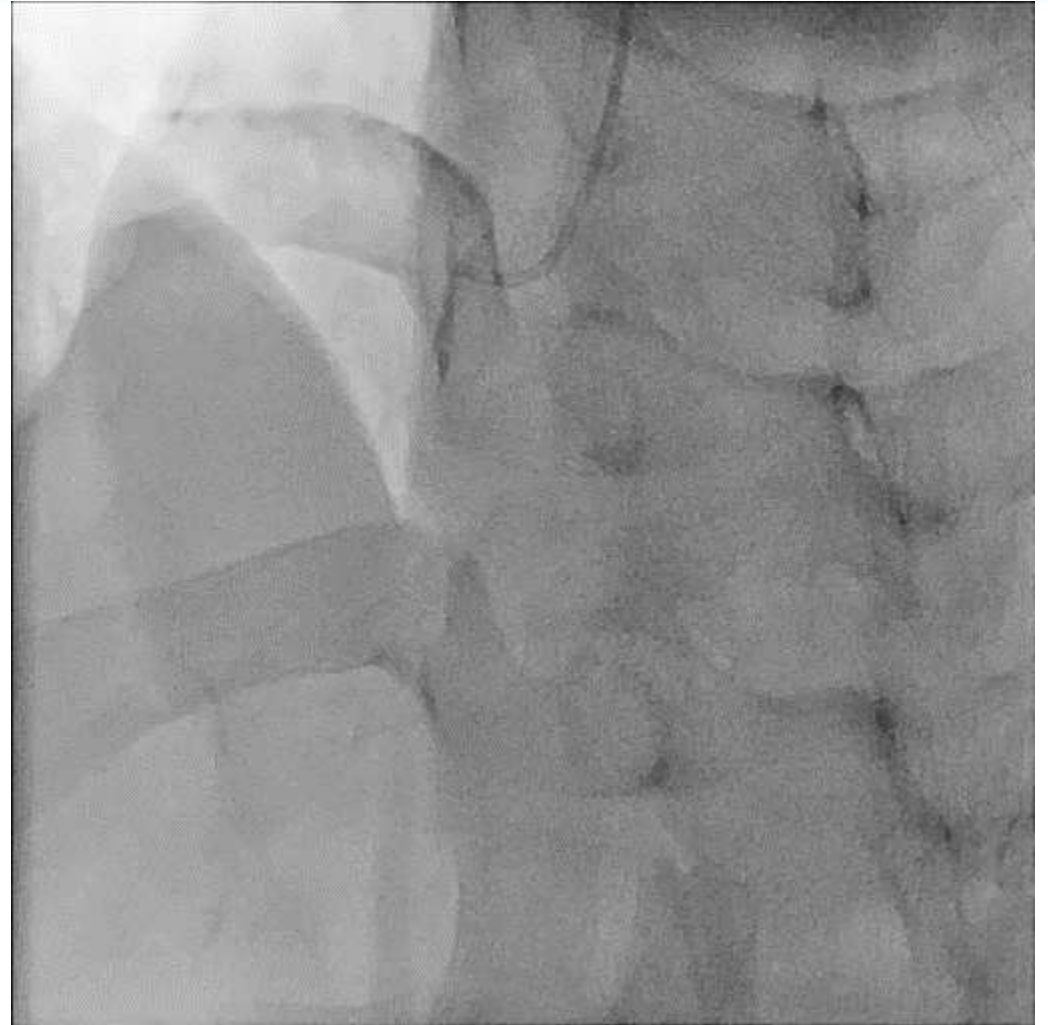
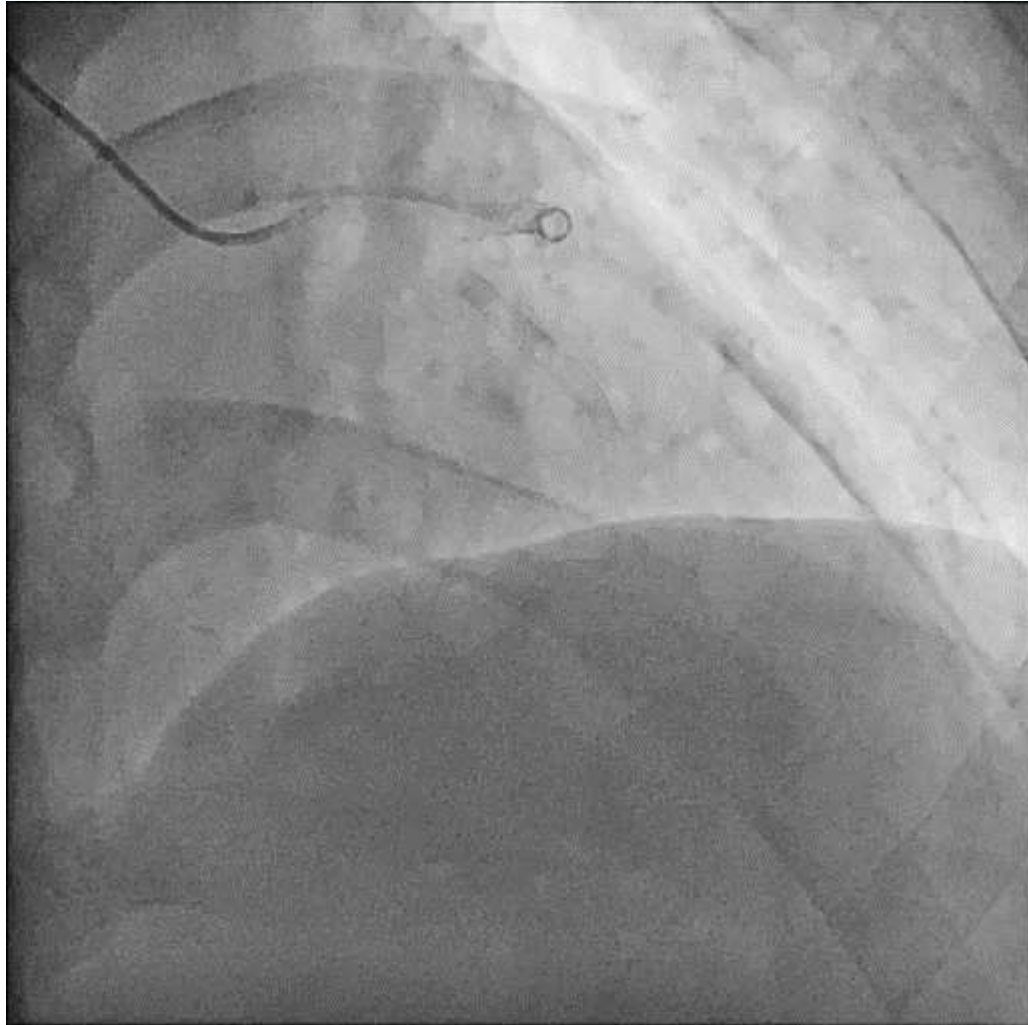




IVUS before DCB



9 months follow up



Summary

- IVUS guided CTO-PCI improve outcomes and give us optimal stenting site.
- However, long stent implantation may lead to worse outcomes.
- Presence of Peri-medial high echoic band (PHB) on IVUS predicts chronic enlargement of the coronary segments distal to the stented lesion.
- However, not all case with PHB show good outcomes and short term follow up angiography should be needed.

