

ISR CTO:
What is the difference from de novo CTO?

Kenya Nasu, MD, FACC
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Procedural and Long-Term Outcomes of Percutaneous Coronary Intervention for In-Stent Chronic Total Occlusion



Lorenzo Azzalini, MD, PhD, MSc,^a Rustem Dautov, MD, PhD,^{b,c} Soledad Ojeda, MD, PhD,^d Susanna Benincasa, MD,^a Barbara Bellini, MD,^a Francesco Giannini, MD,^a Jorge Chavarría, MD,^d Manuel Pan, MD, PhD,^d Mauro Carlino, MD,^a Antonio Colombo, MD,^a Stéphane Rinfret, MD, SM^{b,c}

J Am Coll Cardiol Intv 2017;10:892–902

TABLE 2 Baseline Angiographic Characteristics

	Overall (N = 899)	In-Stent CTO (n = 111)	De Novo CTO (n = 788)	p Value
Number of diseased vessels	1.83 ± 0.81	1.66 ± 0.75	1.86 ± 0.82	0.02
Target-vessel CTO				
Left anterior descending	254 (28.4)	30 (27.0)	224 (28.6)	0.82
Circumflex	174 (19.4)	20 (18.0)	154 (19.6)	
Right coronary artery	467 (52.2)	61 (55.0)	406 (51.8)	
Blunt stump	410 (46.0)	55 (49.5)	355 (45.5)	0.43
Moderate or severe calcifications	392 (43.8)	21 (19.1)	371 (47.2)	<0.001
>45° bending	274 (31.0)	35 (32.1)	239 (30.8)	0.78
Lesion length >20 mm	404 (45.7)	74 (68.5)	330 (42.5)	<0.001
Retry	211 (23.4)	26 (23.4)	185 (23.4)	1.00
J-CTO score	1.88 ± 1.24	1.90 ± 1.21	1.88 ± 1.24	0.84
J-CTO score ≥2	534 (59.3)	72 (64.9)	462 (58.6)	0.21
Proximal cap ambiguity	379 (43.4)	42 (38.9)	337 (44.1)	0.31
Absence of interventional collaterals	181 (20.7)	25 (23.1)	156 (20.4)	0.51
Moderate or severe tortuosity	181 (20.6)	22 (20.2)	159 (20.7)	0.90
Circumflex CTO	174 (19.4)	20 (18.0)	154 (19.6)	0.69
PROGRESS-CTO score	1.04 ± 0.88	1.01 ± 0.79	1.05 ± 0.89	0.65
PROGRESS-CTO score ≥2	248 (28.4)	28 (25.9)	220 (28.8)	0.54
Ostial CTO	135 (15.2)	31 (27.9)	104 (13.3)	<0.001
Distal cap at bifurcation	299 (34.3)	26 (24.3)	273 (35.7)	0.02
Good distal landing zone	662 (75.9)	69 (64.5)	593 (77.5)	0.003
Werner's CC class				
CC0	57 (6.8)	5 (4.9)	52 (7.1)	0.44
CC1	455 (54.2)	63 (61.2)	392 (53.2)	
CC2	328 (39.0)	35 (34.0)	293 (39.8)	

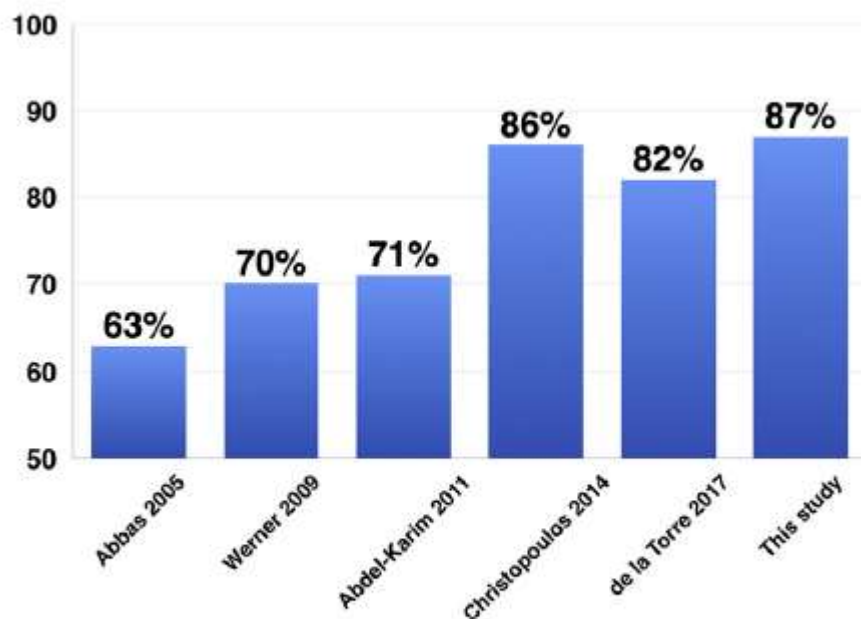
Procedural and Long-Term Outcomes of Percutaneous Coronary Intervention for In-Stent Chronic Total Occlusion



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FIGURE 4 Procedural Success Rates of IS-CTO PCI in the Literature



IS-CTO = in-stent chronic total occlusion; PCI = percutaneous coronary intervention.

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A

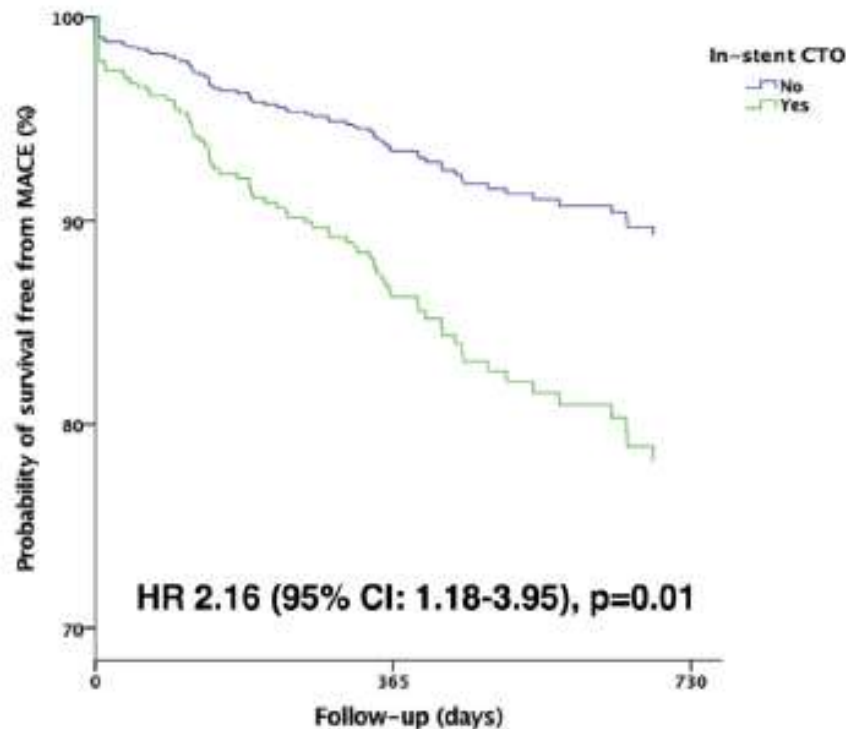
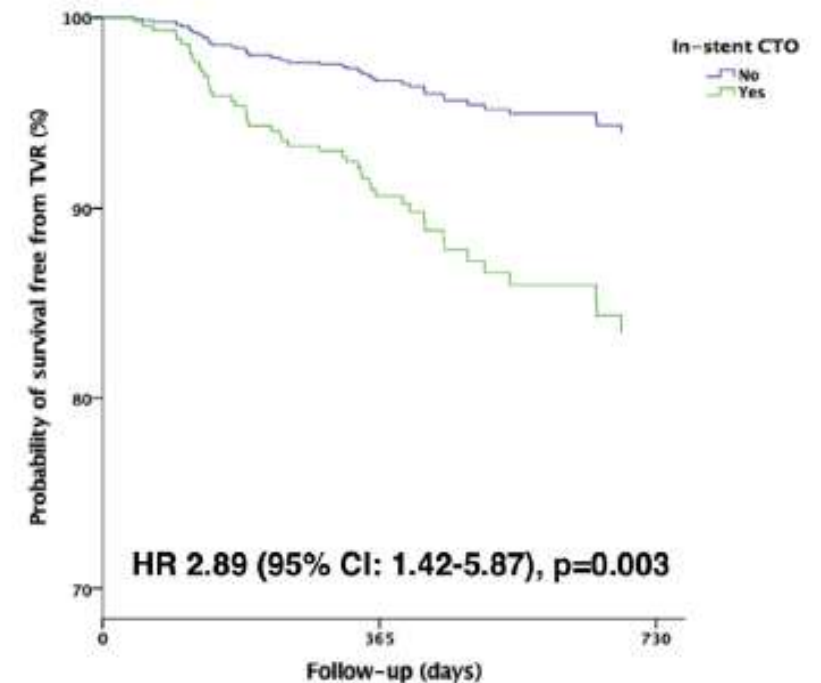


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CC2	328 (39.0)	35 (34.0)	293 (39.8)	

Outcomes of Percutaneous Coronary Interventions for Chronic Total Occlusion Performed by Highly Experienced Japanese Specialists

The First Report From the Japanese CTO-PCI Expert Registry

Yoriyasu Suzuki, MD,^a Etsuo Tsuchikane, MD, PhD,^b Osamu Katoh, MD,^c Toshiya Muramatsu, MD,^d Makoto Muto, MD,^e Koichi Kishi, MD,^f Yuji Hamazaki, MD,^g Yuji Oikawa, MD,^h Tomohiro Kawasaki, MD,ⁱ Atsunori Okamura, MD^j

J Am Coll Cardiol Intv 2017;10:2144–54

TABLE 1 Baseline Patient Characteristics and Baseline Angiographic Characteristics

	Overall (N = 2,596)	PAA (n = 1,872)	PRA (n = 724)	PAA vs. PRA p Value
Age, yrs	66.9 ± 10.9	66.8 ± 10.9	66.9 ± 10.7	0.863
BMI, kg/m ²	24.7 ± 3.8	24.7 ± 3.8	24.6 ± 3.8	0.413
LVEF	54.8 ± 12.9	54.9 ± 12.9	54.6 ± 12.8	0.458
eGFR	64.9 ± 29.0	65.1 ± 30.2	64.3 ± 25.7	0.458
Male	86.1	85.1	88.4	0.018
Hypertension	78.5	78.0	80.8	0.12
Dyslipidemia	77.5	76.1	82.1	0.001
Diabetes	44.9	44.9	45.8	0.35
Current smoking	54.4	58.0	62.3	0.057
OMI	51.0	51.7	51.3	0.895
Prior CABG	7.9	7.4	9.4	0.105
Prior PCI	63.2	61.8	67.5	0.007
Reattempt	20.6	15.1	34.8	<0.0001
Syntax score	15.9 ± 8.6	16.0 ± 8.4	15.6 ± 8.9	0.062
J-CTO score	2.0 ± 1.1	1.9 ± 1.1	2.4 ± 1.1	<0.0001
Number of diseased vessels				0.015
Single VD	49.1	50.6	45.1	
Double VD	30.1	28.8	33.5	
Triple VD	17.1	17.3	16.6	
LMT + multiple VD	3.8	3.3	4.9	
Target vessel				<0.0001
LAD	30.9	32.9	25.7	
LCX	17.1	20.4	8.6	
LMT	0.6	0.6	0.6	
RCA	51.5	46.2	65.2	
In-stent occlusion	13.6	16.9	5.1	<0.0001
Distal runoff <3.0 mm	65.0	64.9	67.2	0.274
CTO length ≥20 mm	60.5	57.0	69.6	<0.0001

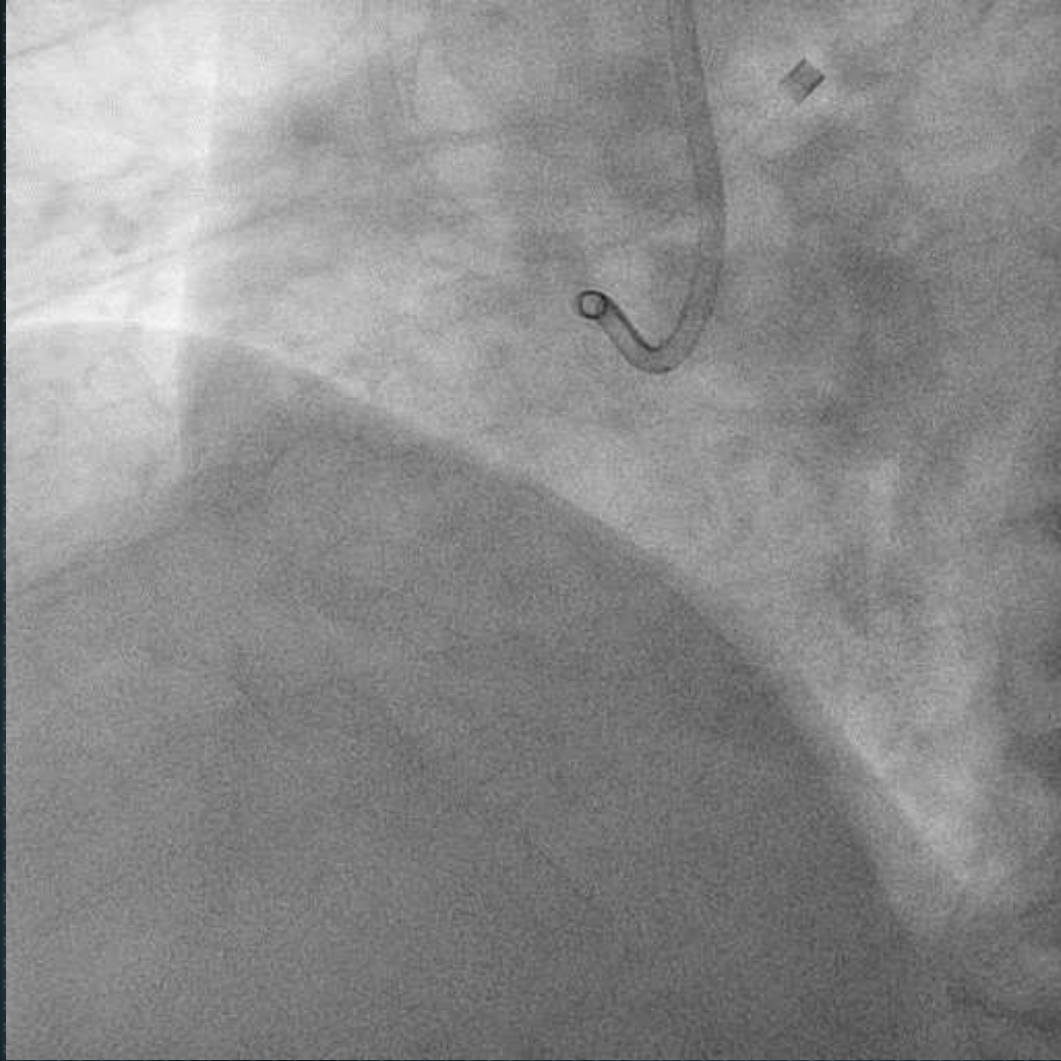
	In stent CTO (%)	De novo CTO (%)
Number	462	2107
Lesion location		
LAD	29.4	30.9
LCX	14.9	17.1
LMT	0.5	0.6
RCA	55.2	51.5
Distal run off <3.0mm	91	65
CTO length >20mm	75.1	60.5
SB at proximal cap	26.4	34.1
Calcification	34.2	50.3
Tortuosity of CTO	29.6	24.6
Morphology of P. cap		
Blunt	33.5	23.7
No stump	15.6	19.1
Tapered	50.9	56.7
J CTO score	2.2±1.0	2.0±1.0

	In stent CTO (%)	De novo CTO (%)
Procedural success	94.3	88.8
Contrast volume	225±98	230±105
Procedure time	135±68	160±90
Antegrade alone	76.4	54.1
Success rate	98.5	-
Rescue or primary Retrograde	23.6	45.9
Success rate	80.7	-

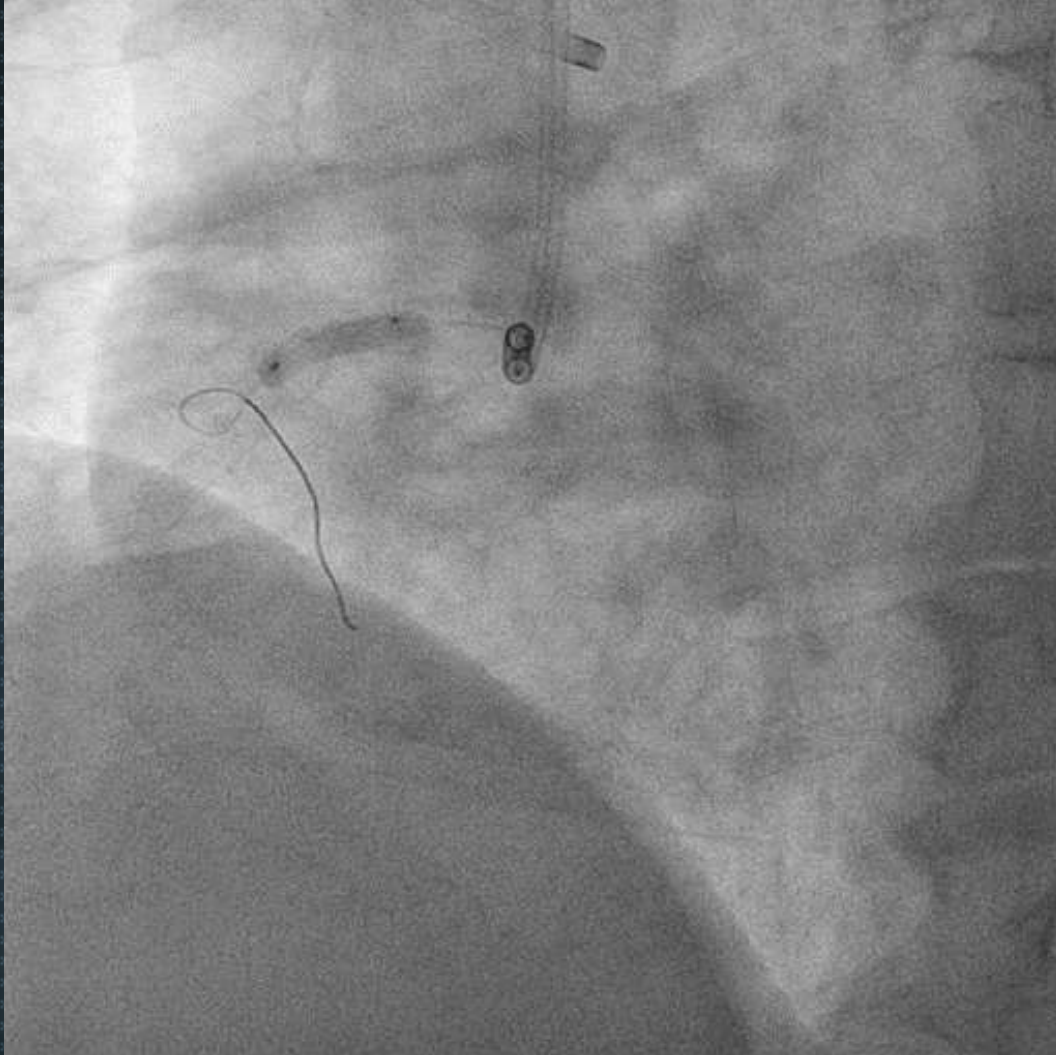
Summary

- **In-stent restenosis related CTO lesions are observed 10-15% in daily CTO procedure.**
- **In-stent CTO has less calcification but longer occlusion length compared with de-novo CTO.**
- **Overall procedural success rate is similar to de novo CTO**
- **However, it decreases in case with requiring retrograde approach.**

Case1: RCA in-stent CTO

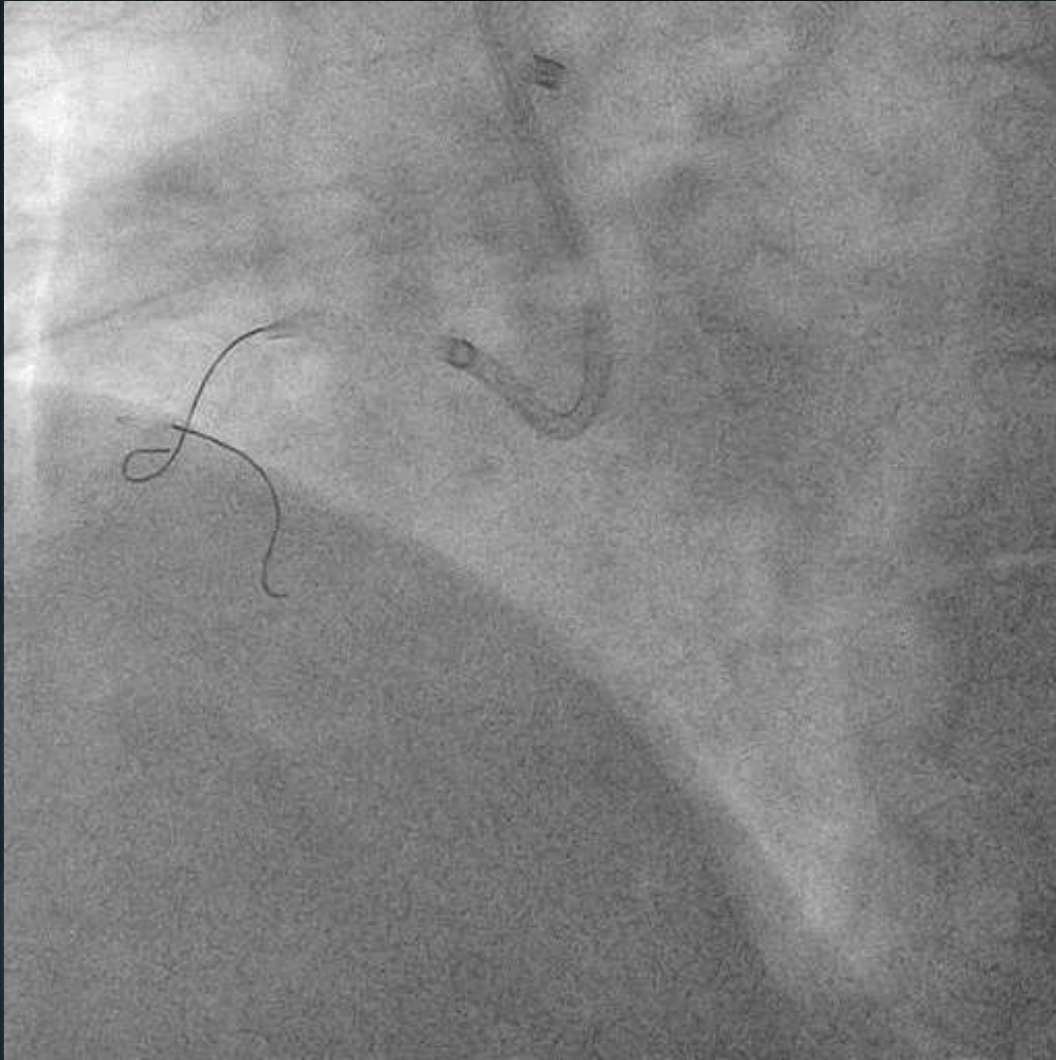


Case1: RCA in-stent CTO



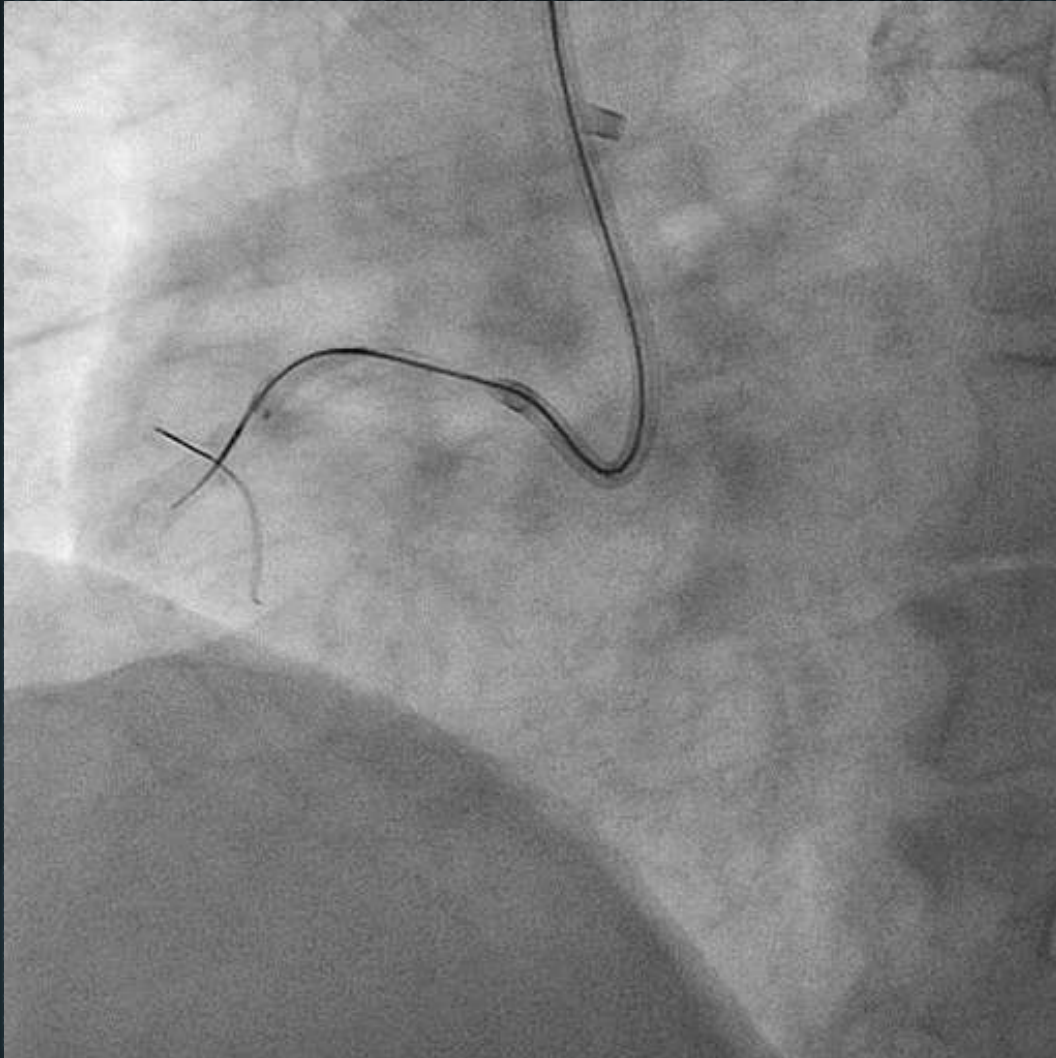
- ✓ 8Fr AL1SH
- ✓ POBA 3.5mm for Proximal RCA

Case1: RCA in-stent CTO



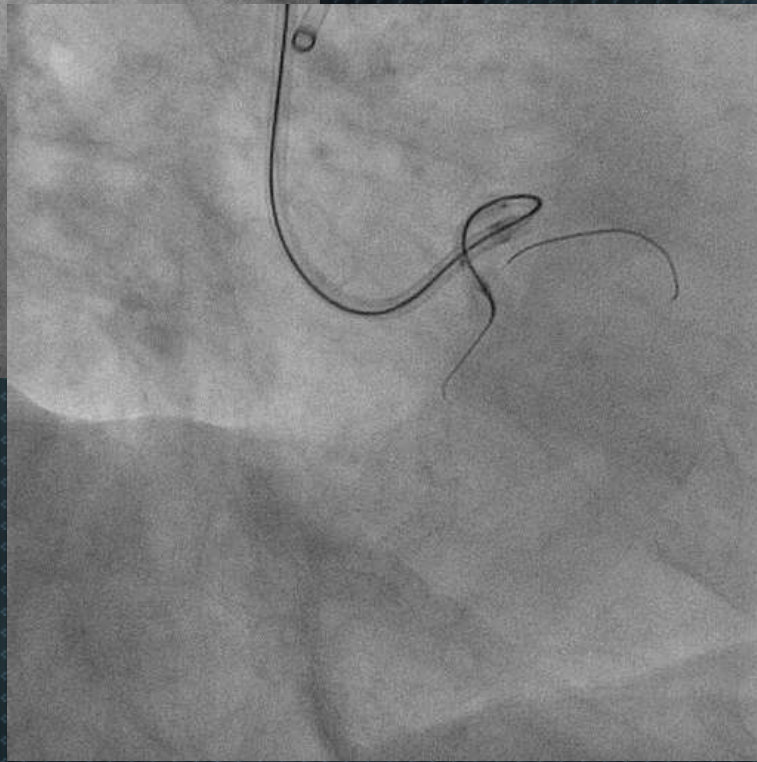
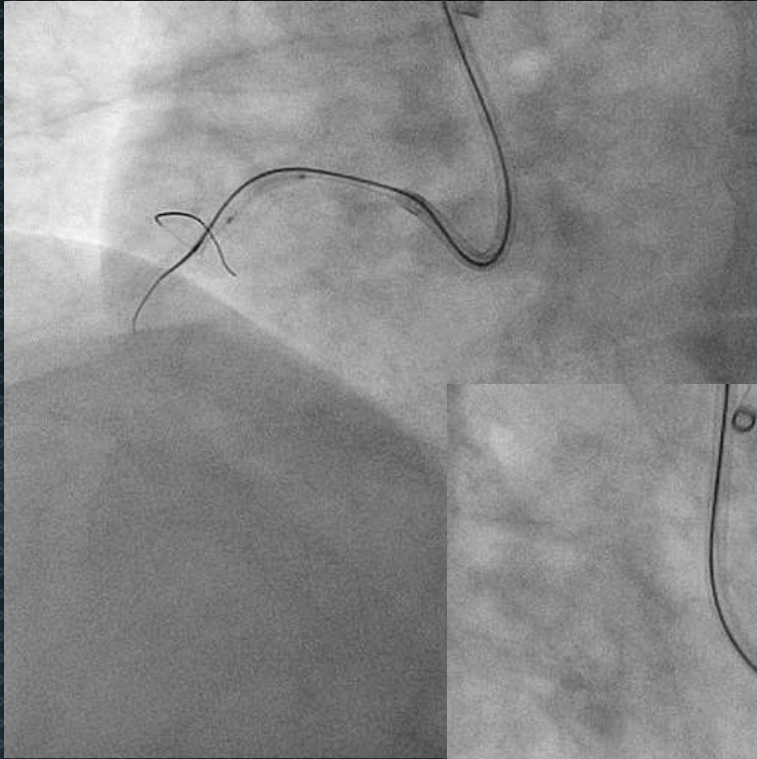
- ✓ 8Fr AL1SH
- ✓ POBA 3.5mm for Proximal RCA
- ✓ 4Fr Child catheter

Case1: RCA in-stent CTO



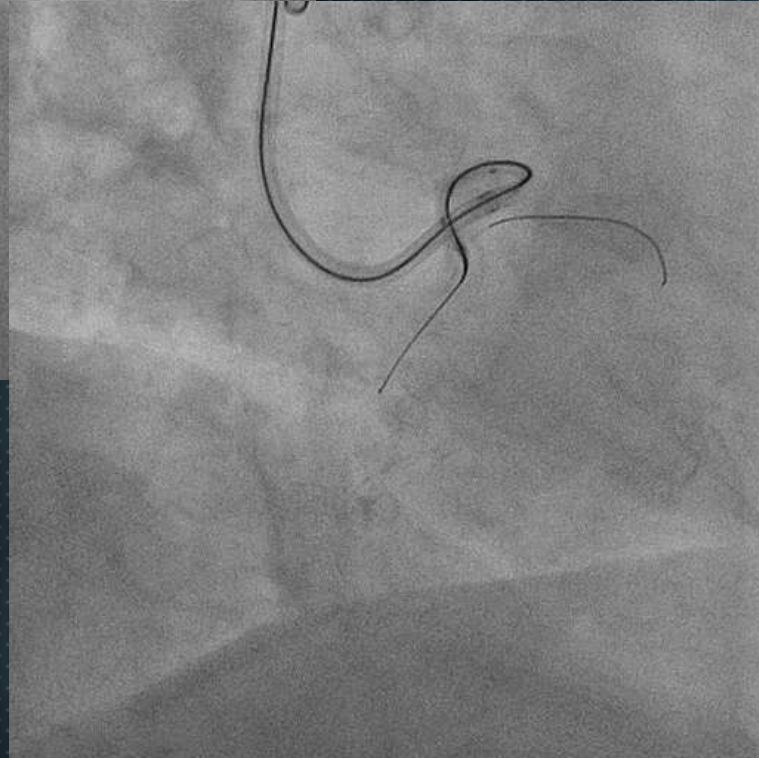
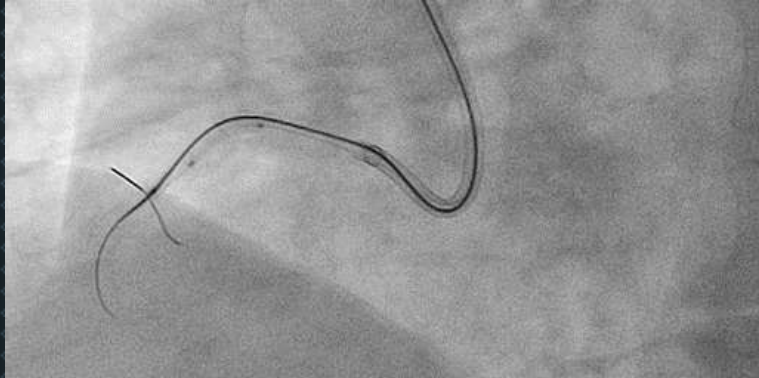
- ✓ 8Fr AL1SH
- ✓ POBA 3.5mm for Proximal RCA
- ✓ 4Fr Child catheter
- ✓ 4Fr Child catheter fixed by 2.5mm POBA

Case1: RCA in-stent CTO



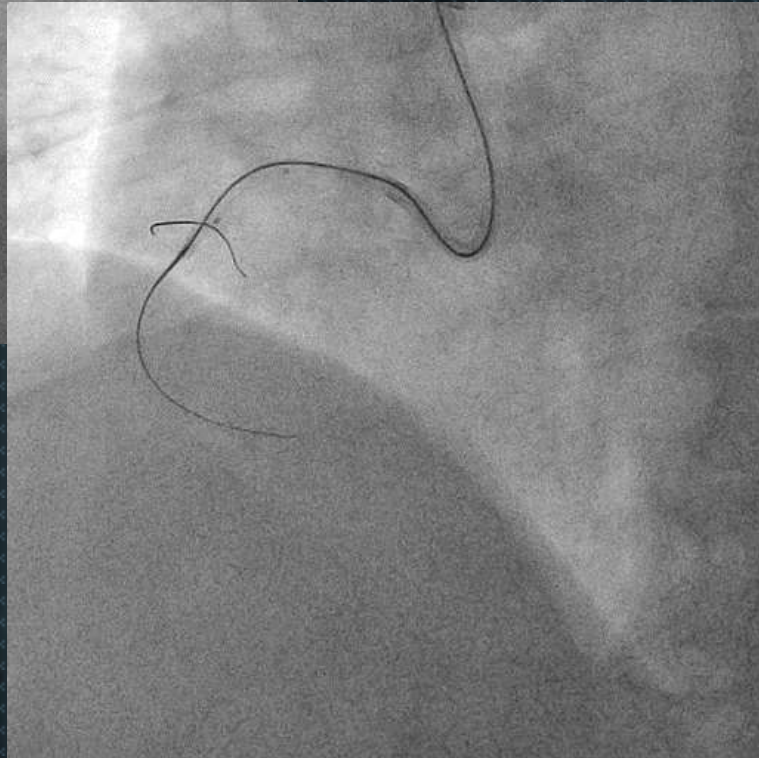
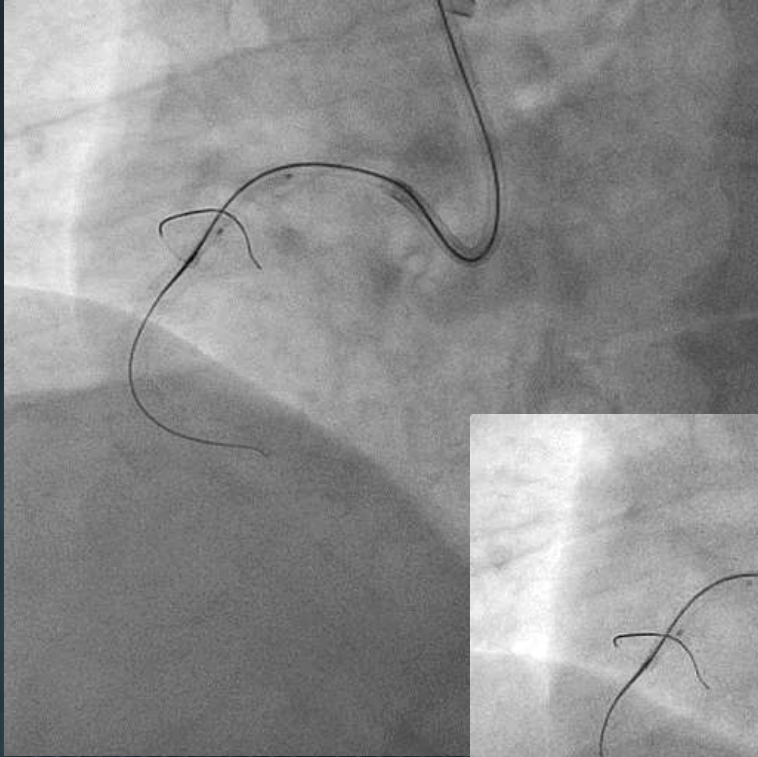
- ✓ 8Fr AL1SH
- ✓ POBA 3.5mm for Proximal RCA
- ✓ 4Fr Child catheter
- ✓ 4Fr Child catheter fixed by 2.5mm POBA
- ✓ GAIA 2nd

Case1: RCA in-stent CTO



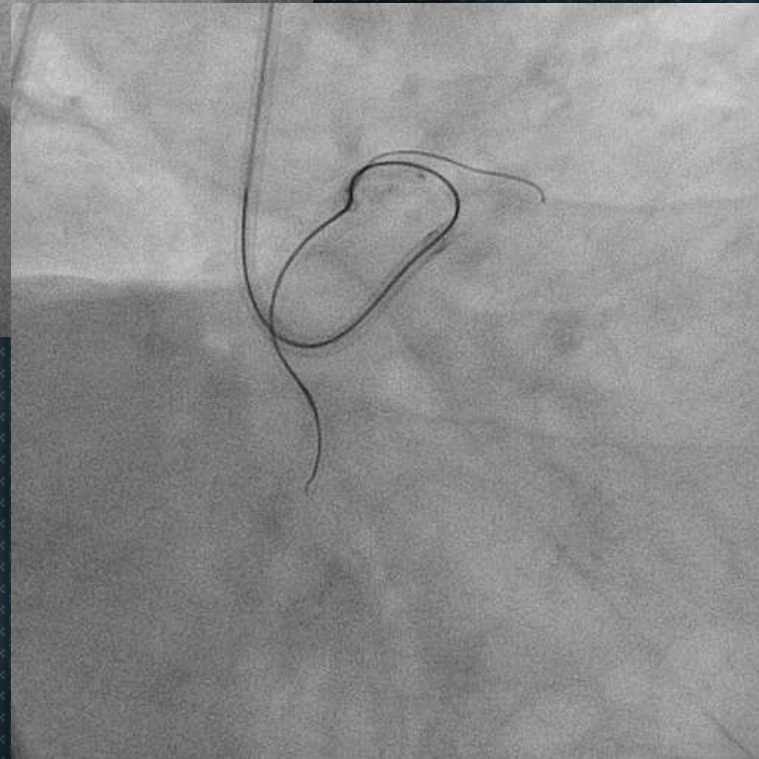
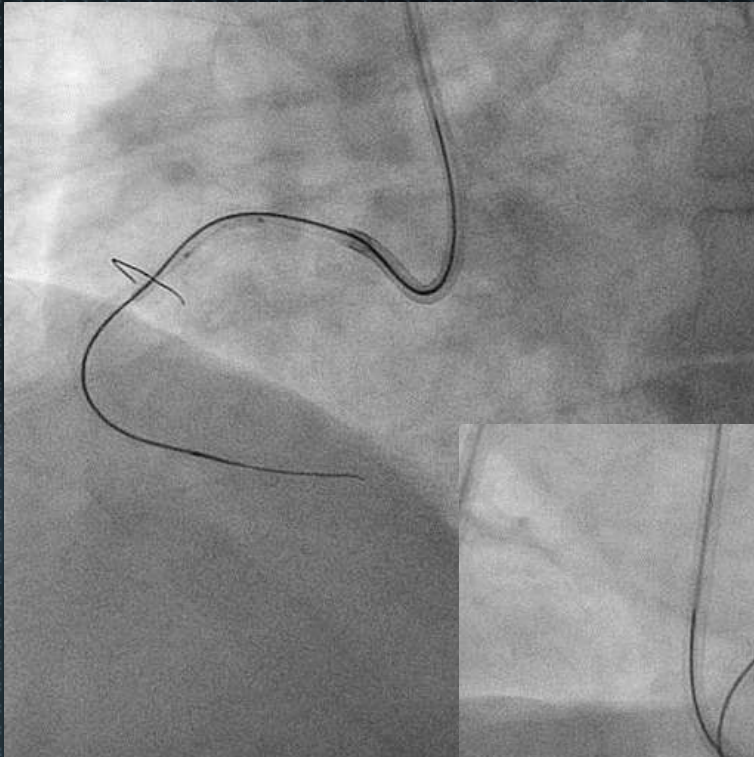
- ✓ 8Fr AL1SH
- ✓ POBA 3.5mm for Proximal RCA
- ✓ 4Fr Child catheter
- ✓ 4Fr Child catheter fixed by 2.5mm POBA
- ✓ GAIA 2nd → GAIA 3rd → Conq12

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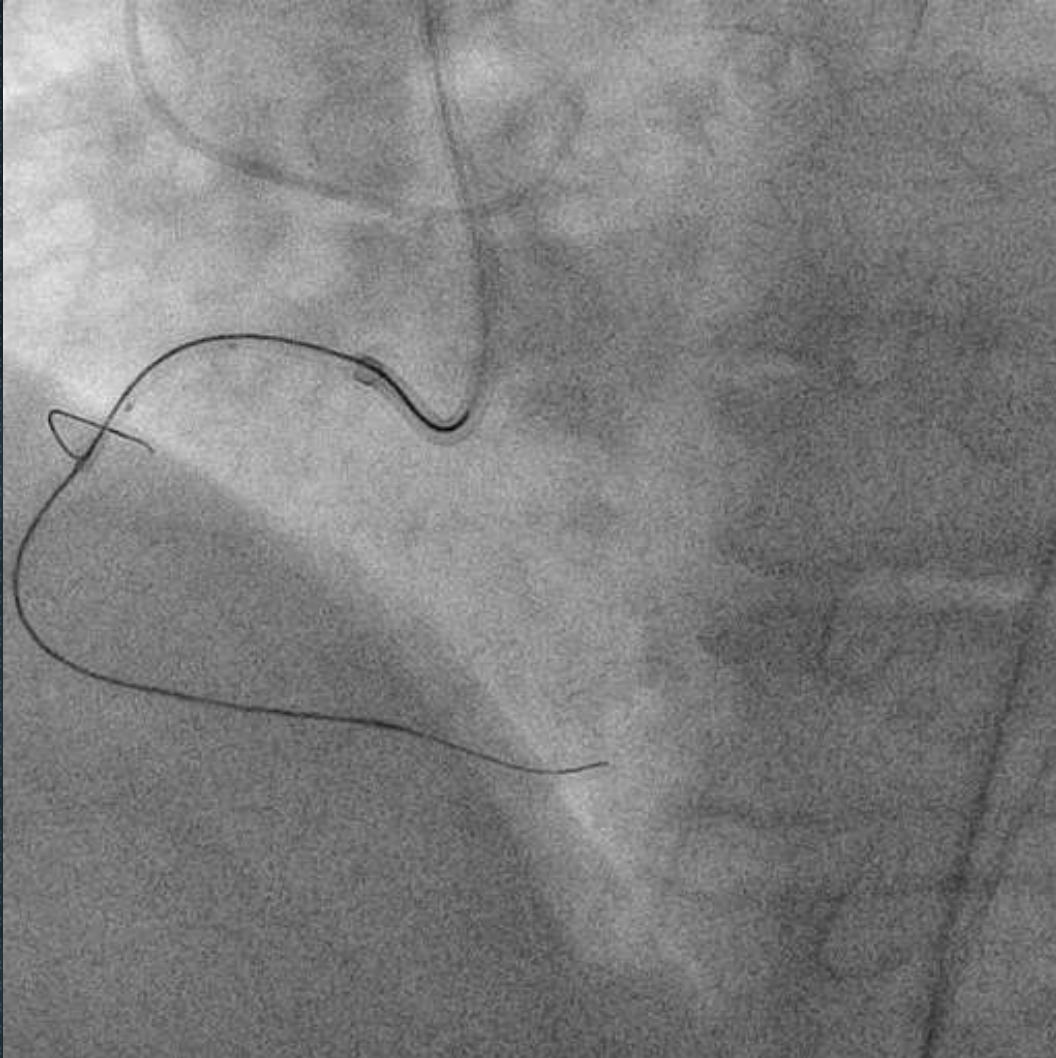
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- ✓ GAIA 2nd → GAIA 3rd → Conq12
- ✓ Corsair advanced

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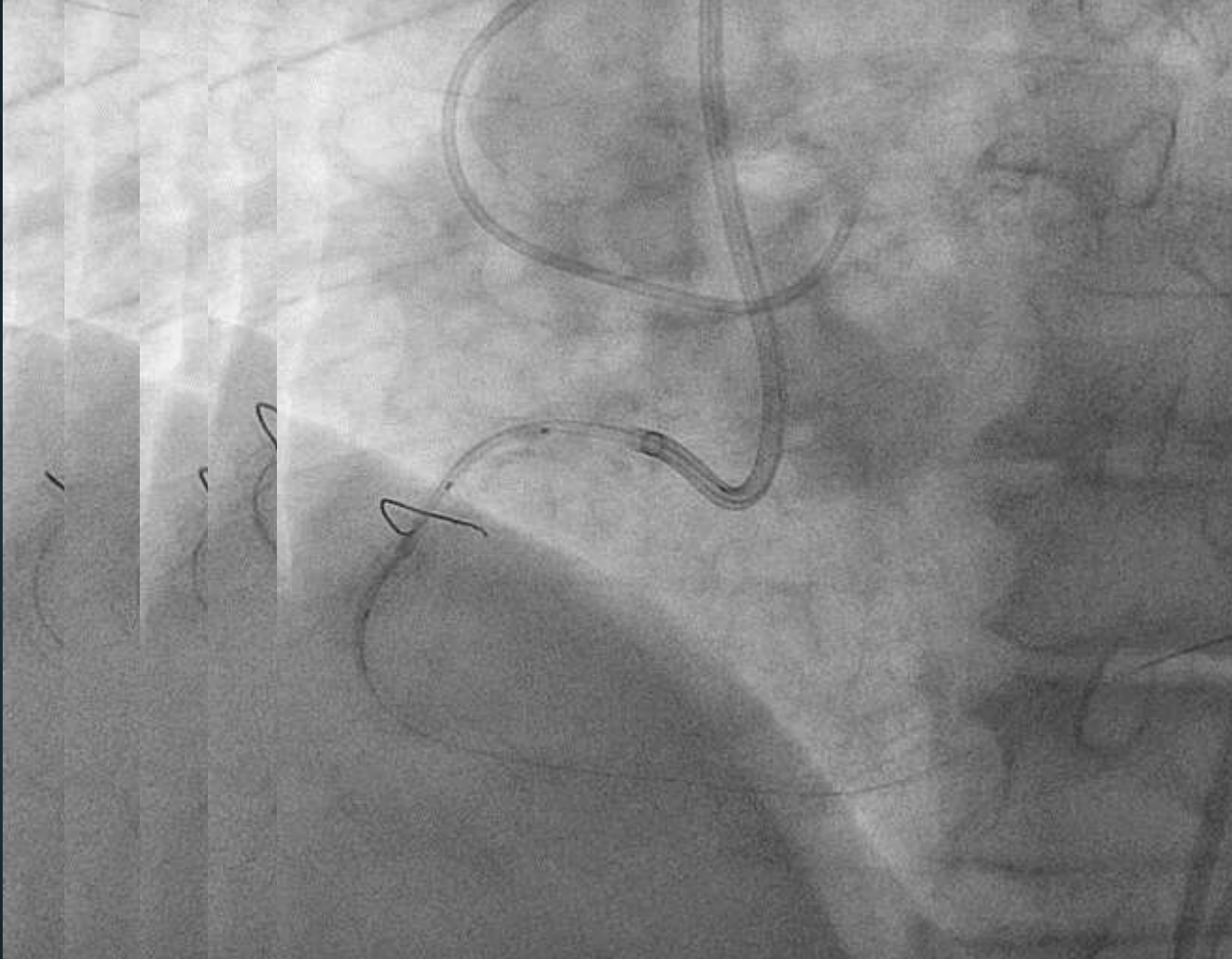
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- ✓ Corsair advanced

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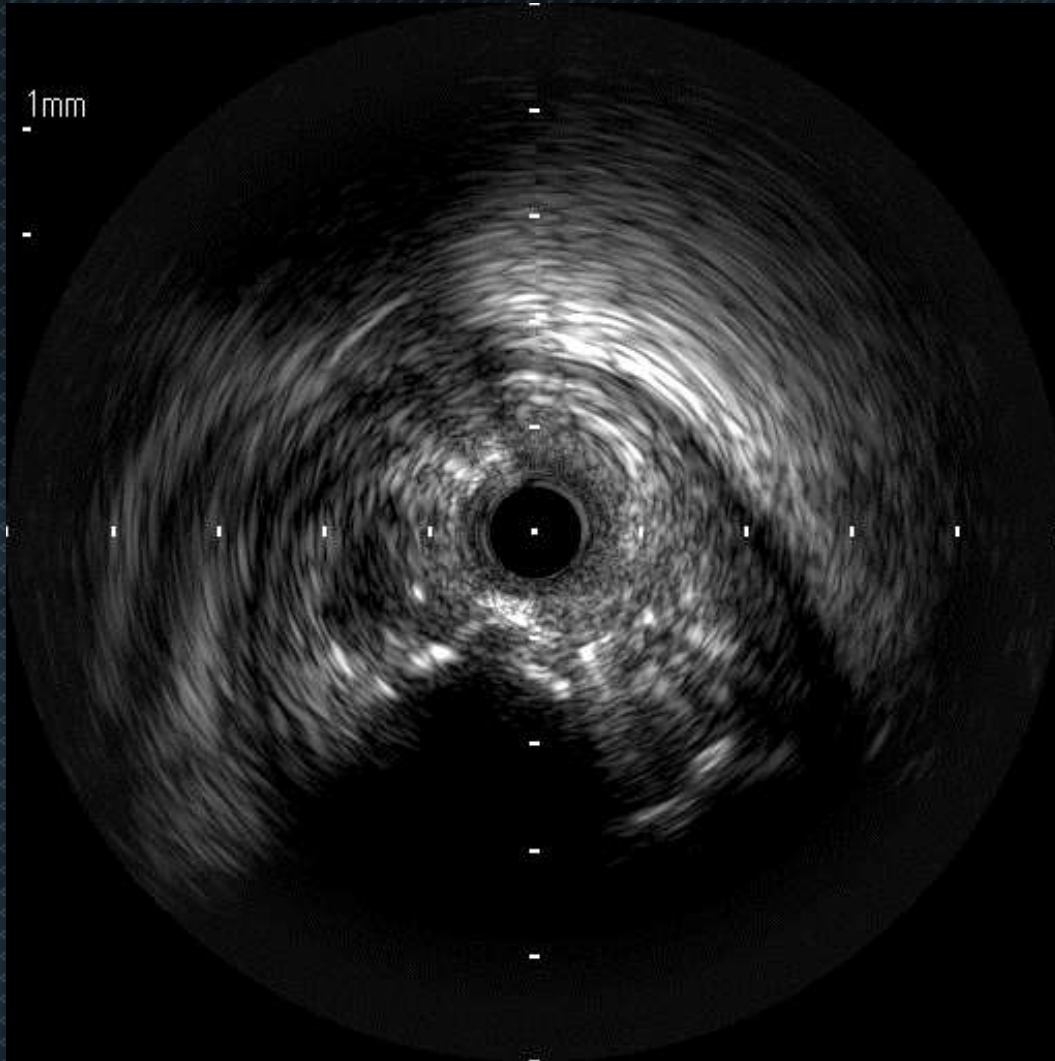
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- ✓ POBA 3.5mm for Proximal RCA
- ✓ 4Fr Child catheter
- ✓ 4Fr Child catheter fixed by 2.5mm POBA
- ✓ GAIA 2nd → GAIA 3rd → Conq12
- ✓ Corsair advanced

Case1: RCA in-stent CTO



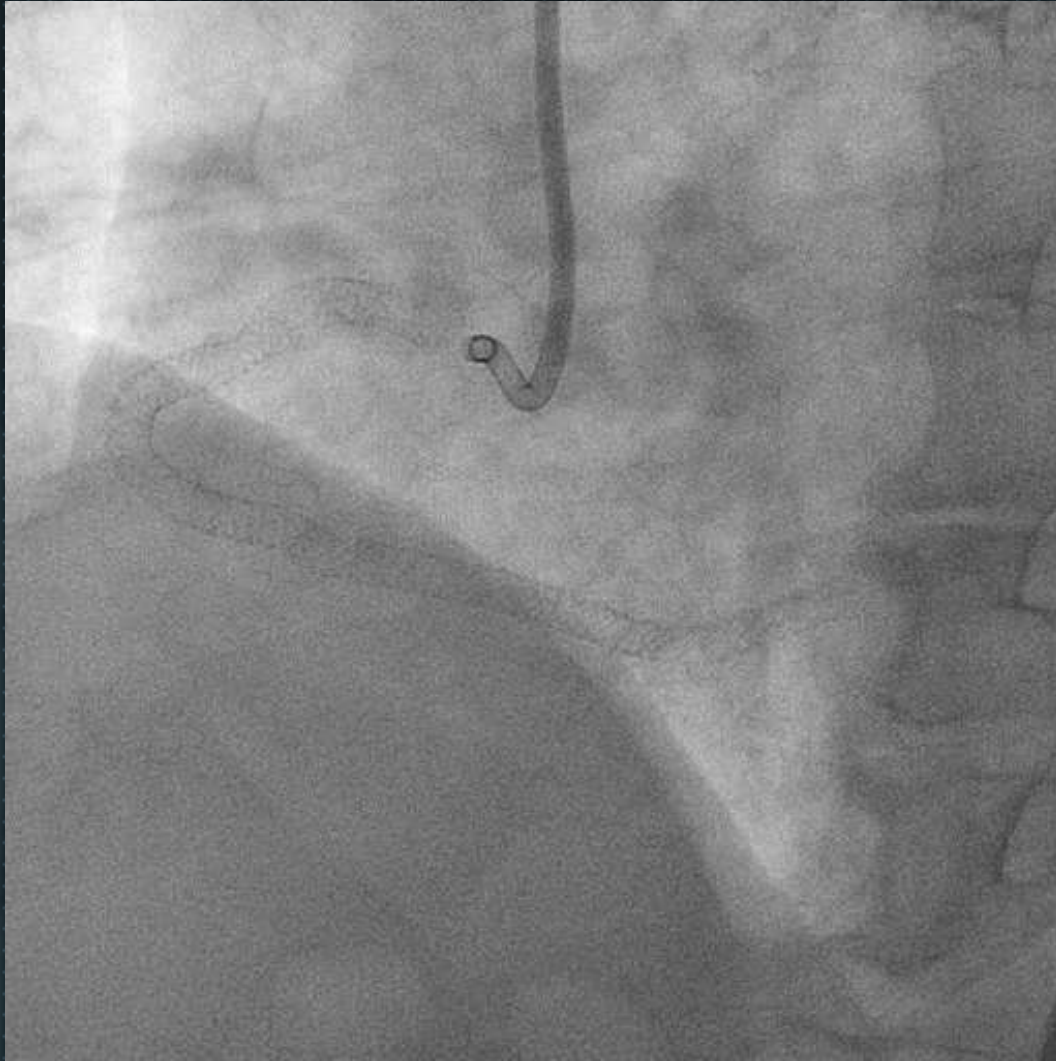
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- ✓ POBA 3.5mm for Proximal RCA
- ✓ 4Fr Child catheter
- ✓ 4Fr Child catheter fixed by 2.5mm POBA
- ✓ GAIA 2nd→GAIA 3rd→Conq12
- ✓ Corsair advanced
- ✓ POBA 2.0mm

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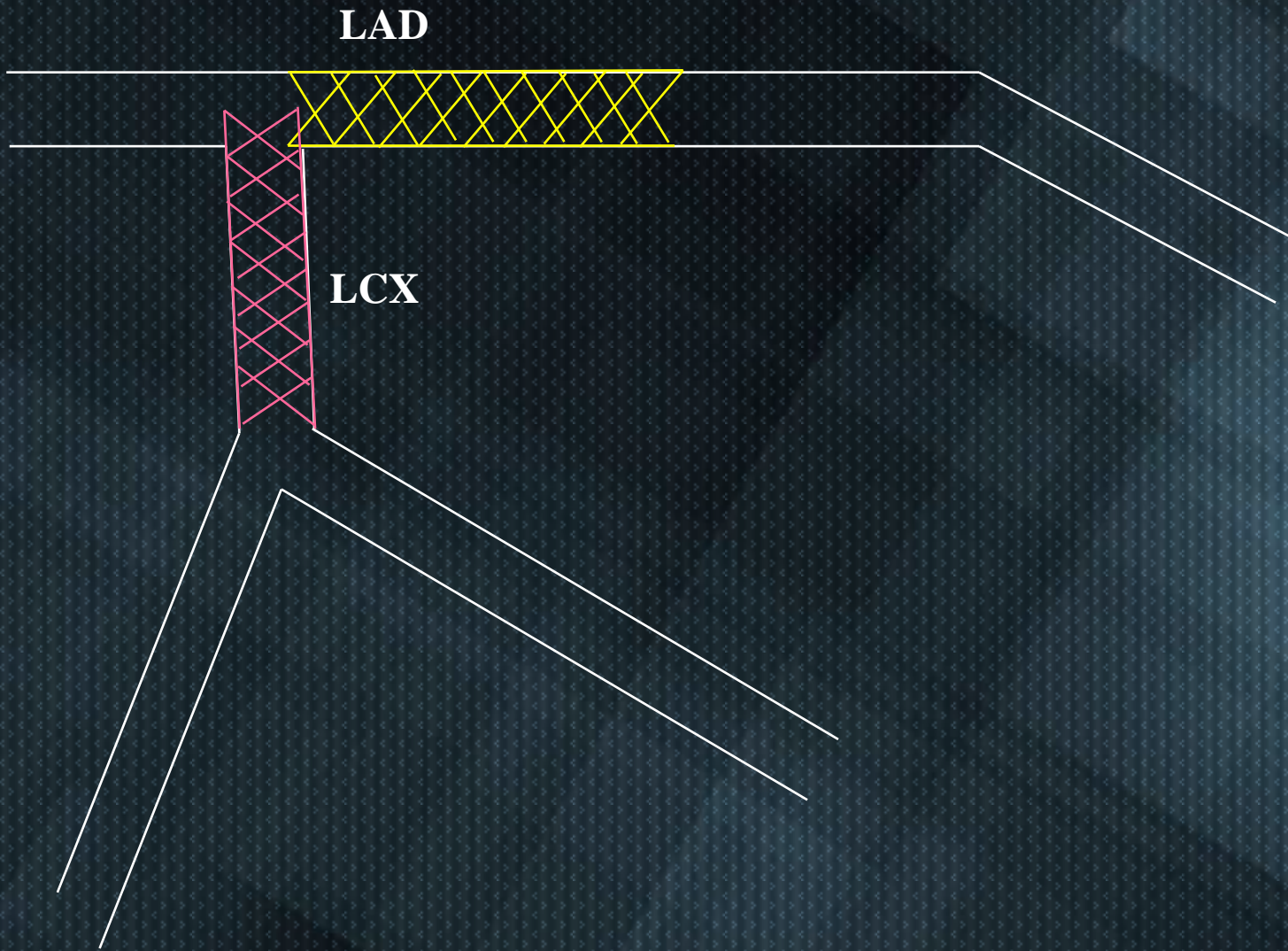
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- ✓ POBA 3.5mm for Proximal RCA
- ✓ 4Fr Child catheter
- ✓ 4Fr Child catheter fixed by 2.5mm POBA
- ✓ GAIA 2nd→GAIA 3rd→Conq12
- ✓ Corsair advanced
- ✓ POBA 2.0mm
- ✓ IVUS

Case1: RCA in-stent CTO



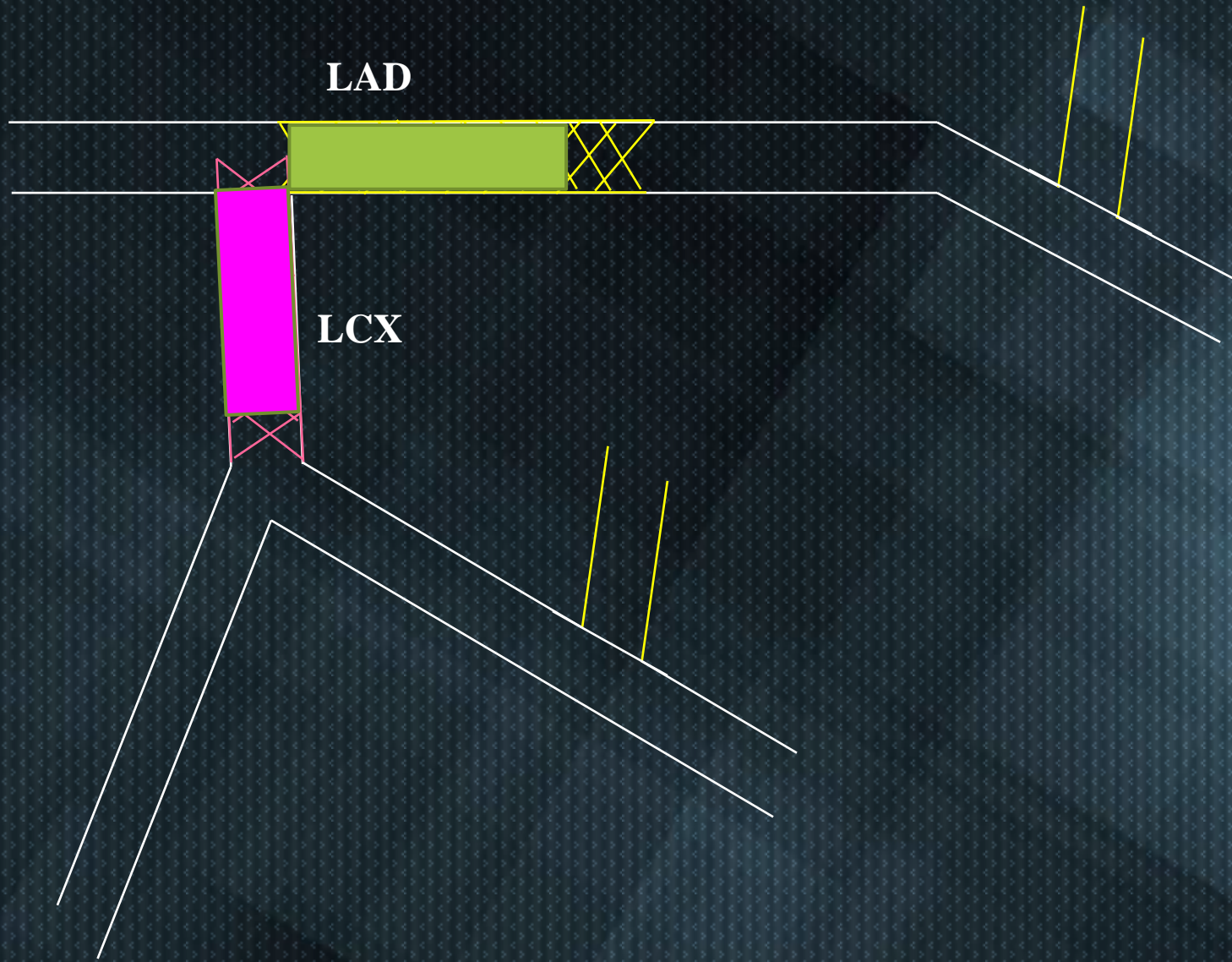
- ✓ 8Fr AL1SH
- ✓ POBA 3.5mm for Proximal RCA
- ✓ 4Fr Child catheter
- ✓ 4Fr Child catheter fixed by 2.5mm POBA
- ✓ GAIA 2nd→GAIA 3rd→Conq12
- ✓ Corsair advanced
- ✓ POBA 2.0mm
- ✓ IVUS
- ✓ DCB

Case2: LAD in-stent CTO



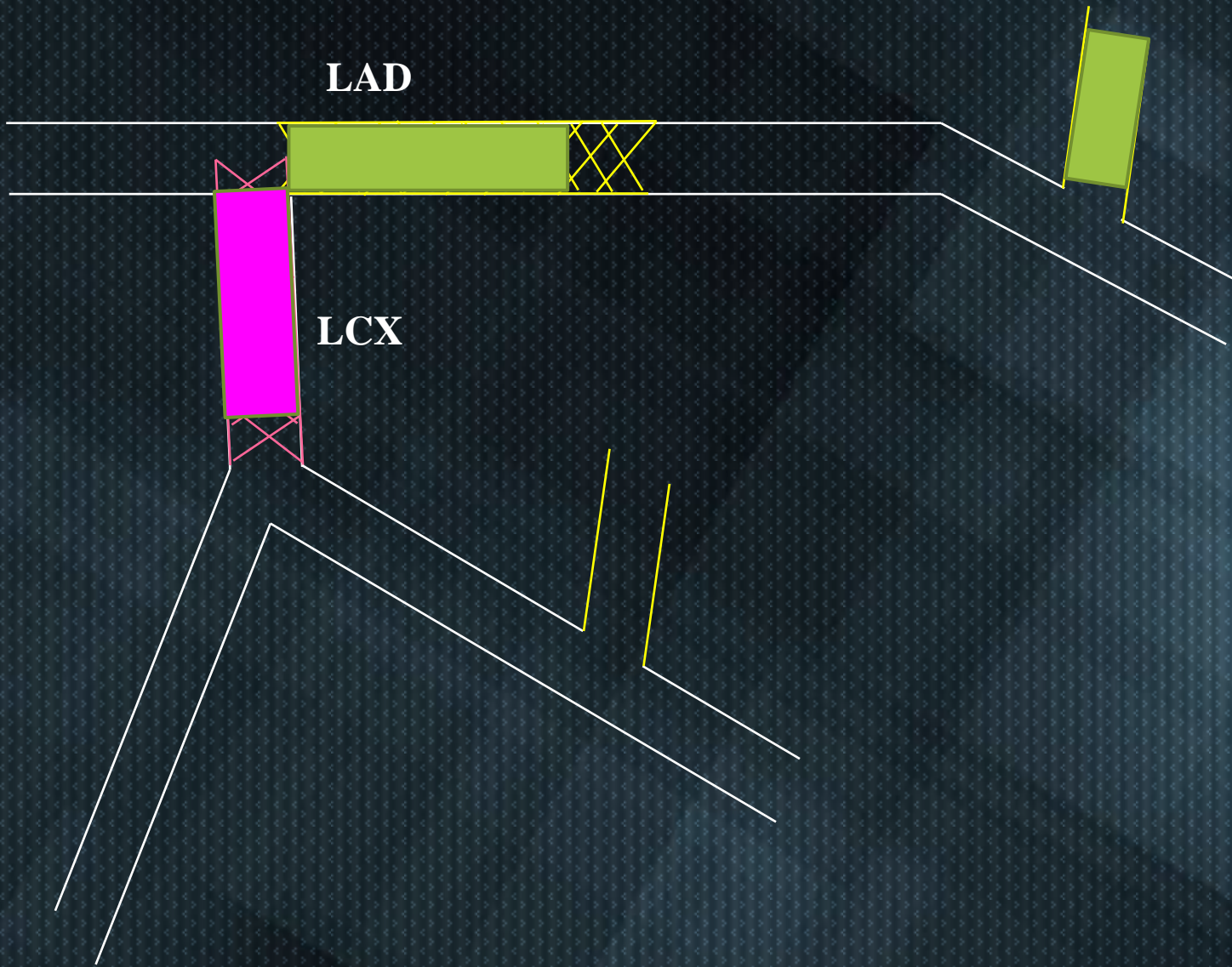
- ✓ 2008/6/14
LAD proximal
TAXUS Liberté 3.0*28
- ✓ 2008/9/28
LCXos
TAXUS Liberté 2.5*16

Case2: LAD in-stent CTO



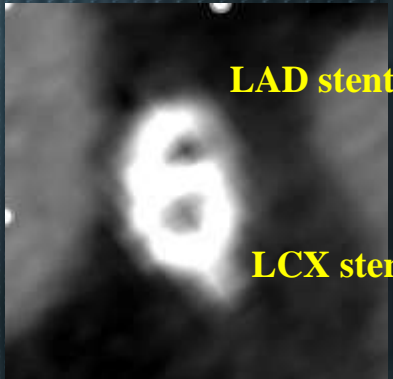
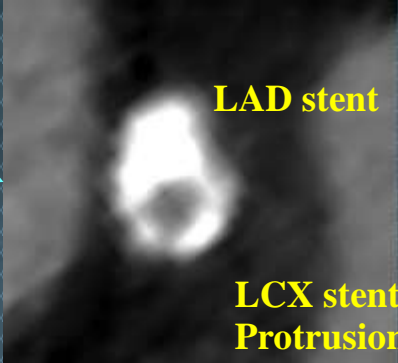
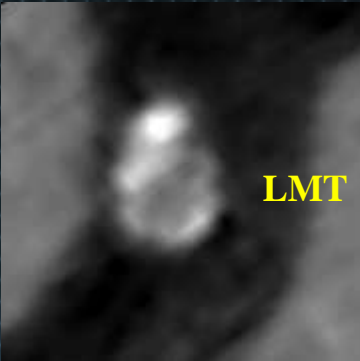
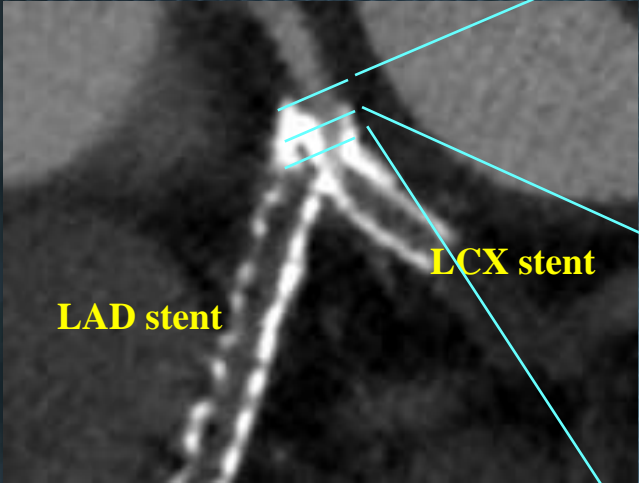
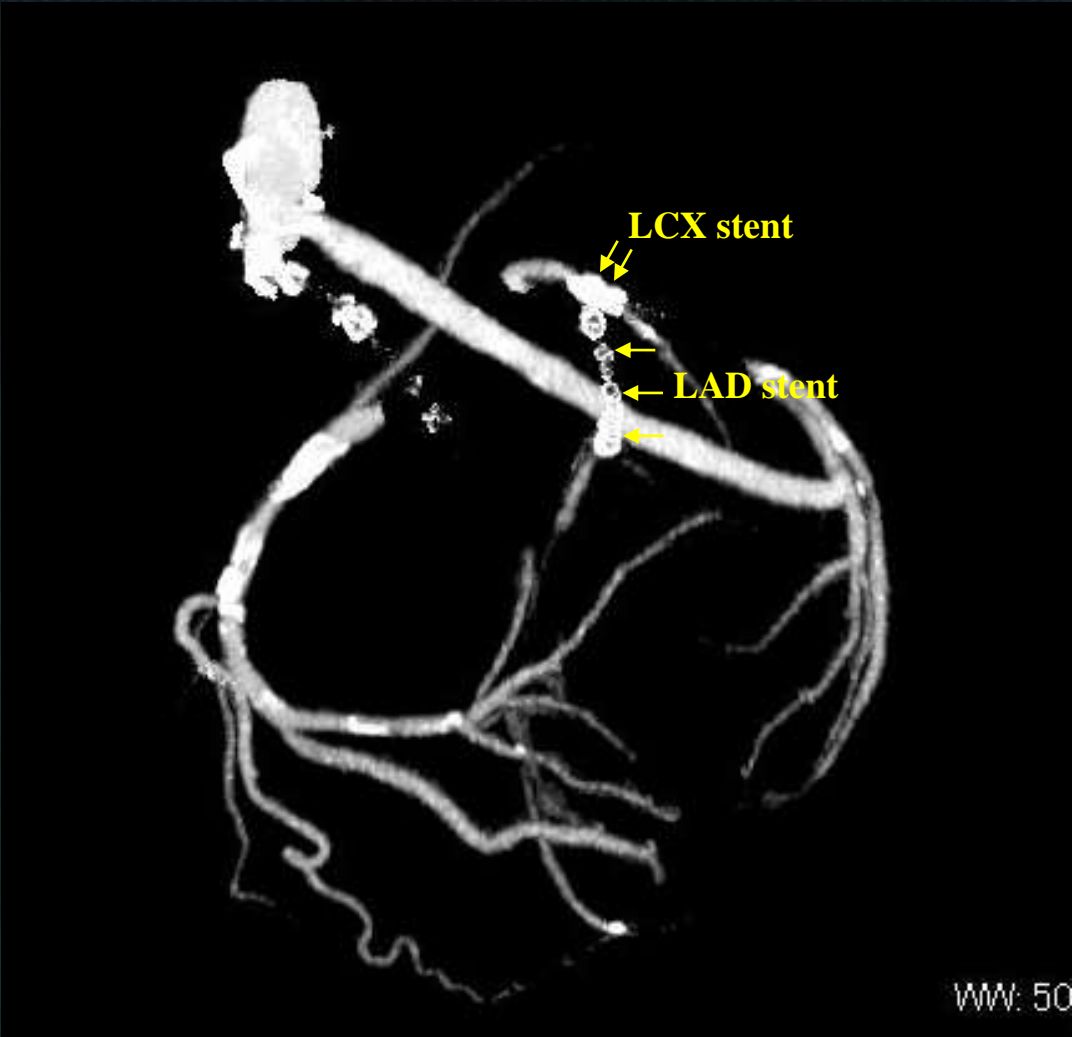
- ✓ 2008/6/14
LAD proximal
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- ✓ 2008/9/28
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- ✓ 2011/6/22
UAP due to occlusion of both stents
→ Emergent CABG
(Ao-SVG-LAD, Ao-SVG-LCX)

Case2: LAD in-stent CTO

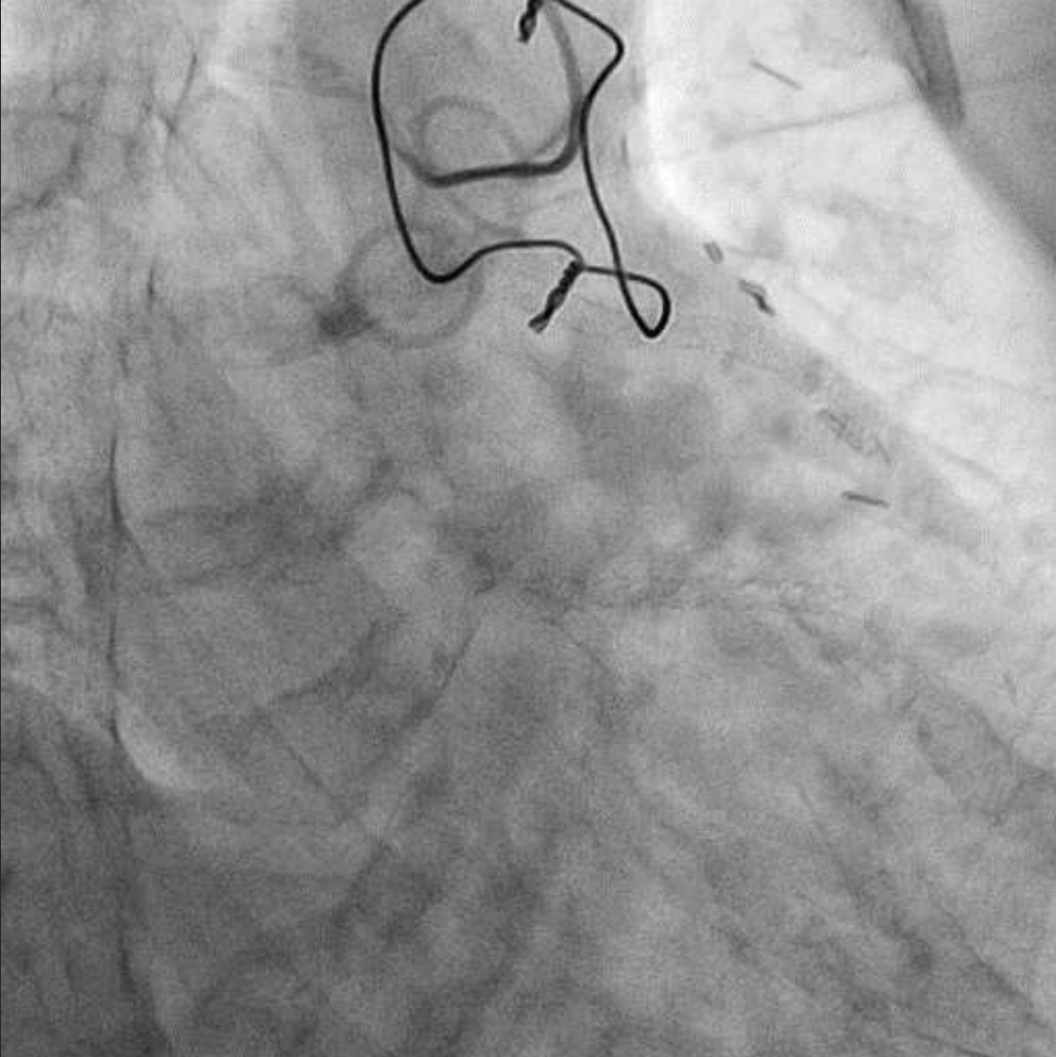
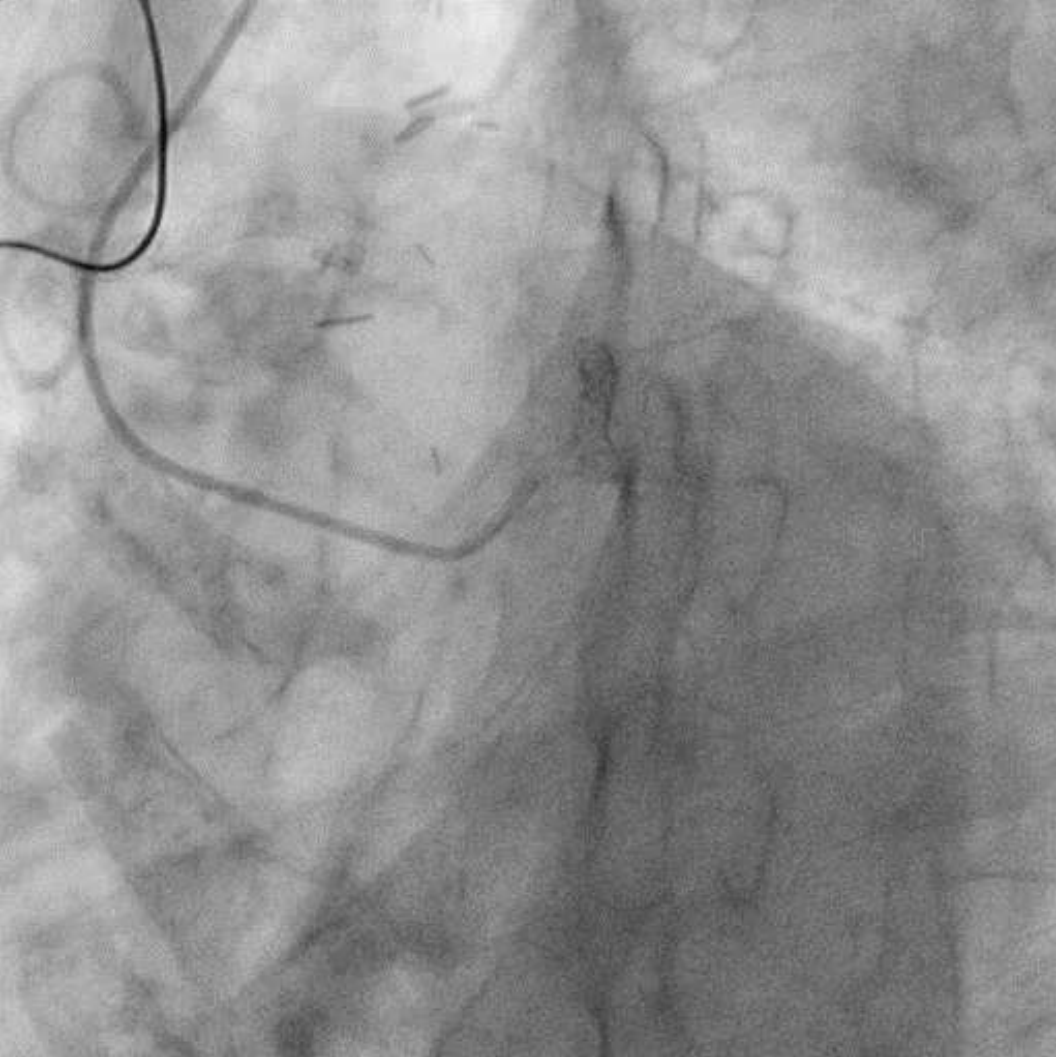


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- ✓ 2008/9/28
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TAXUS Liberté 2.5*16
- ✓ 2011/6/22
UAP due to occlusion of both stents
→ Emergent CABG
(Ao-SVG-LAD, Ao-SVG-LCX)
- ✓ 2016/8~ Chest discomfort on effort
2017/2/22 MSCT and CAG
Ao-SVG-LAD: Occluded
Ao-SVG-LCX: Patent
Both stents: Occluded

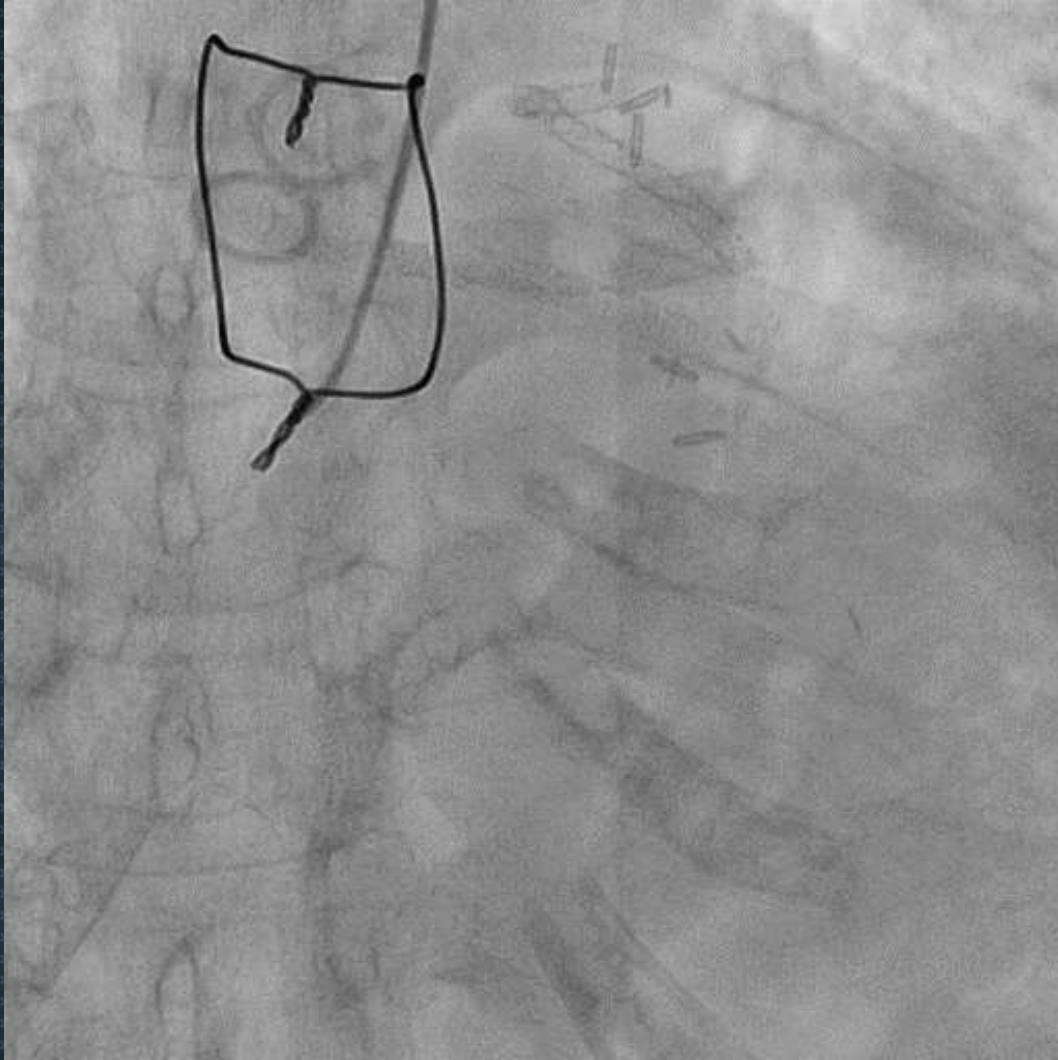
Case2: LAD in-stent CTO



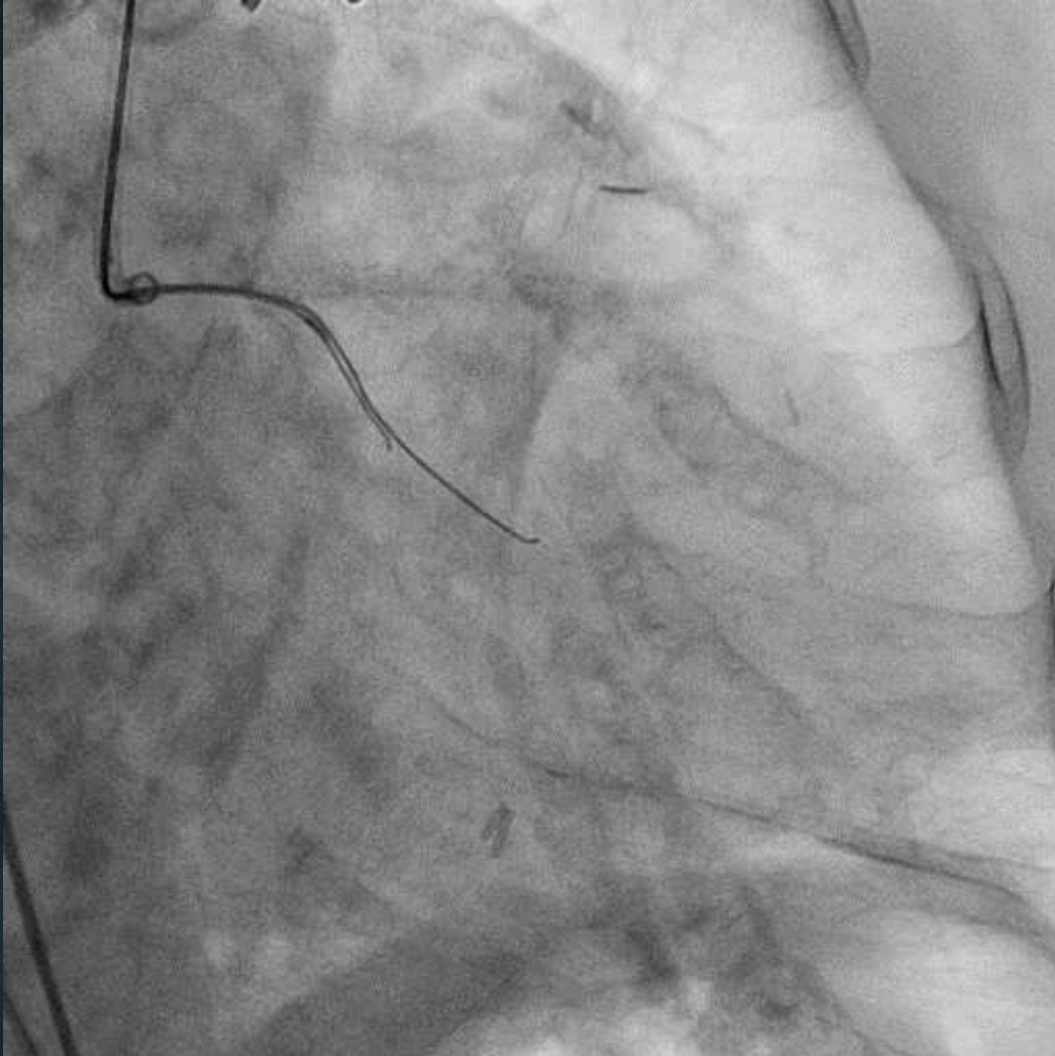
Case2: LAD in-stent CTO



Case2: LAD in-stent CTO

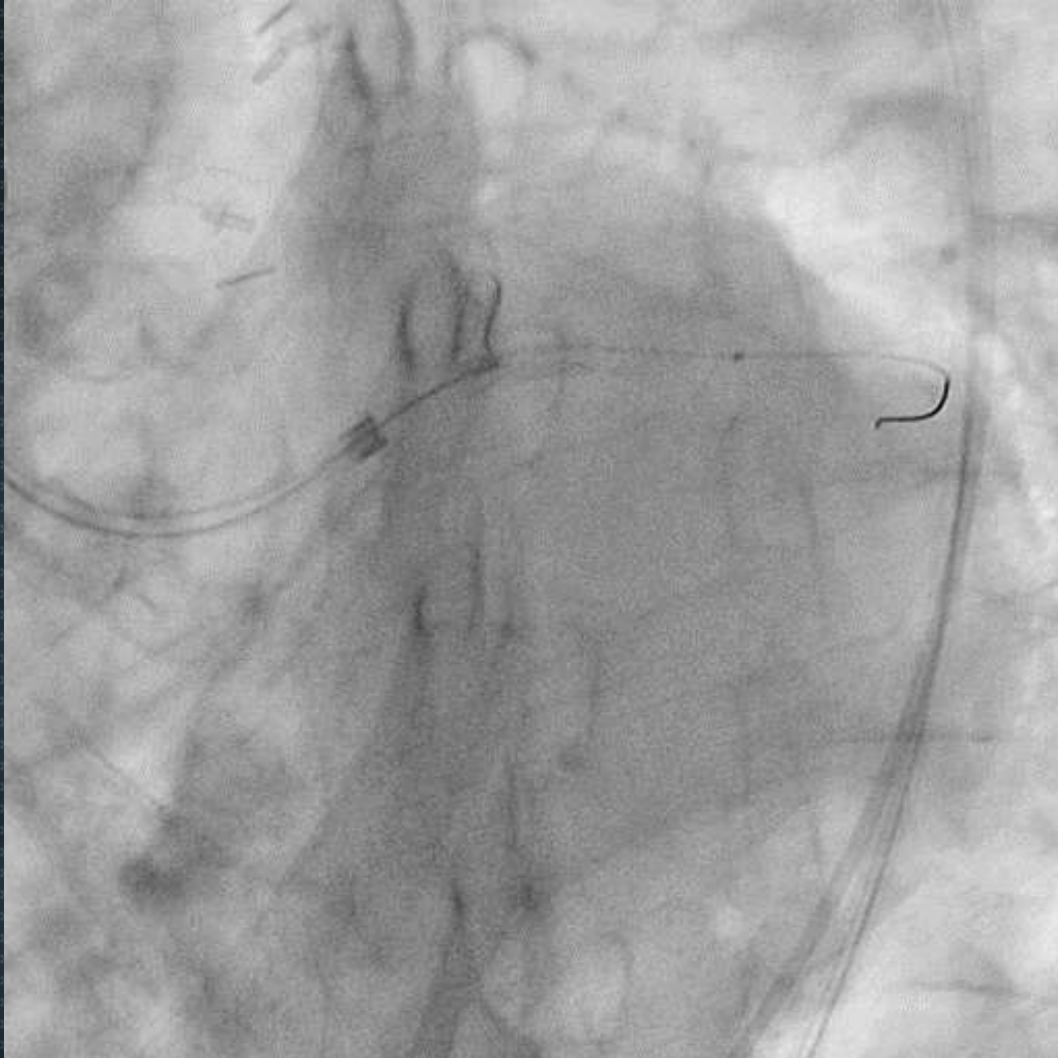


Case2: LAD in-stent CTO



✓ GAIA Next 2 for LCX

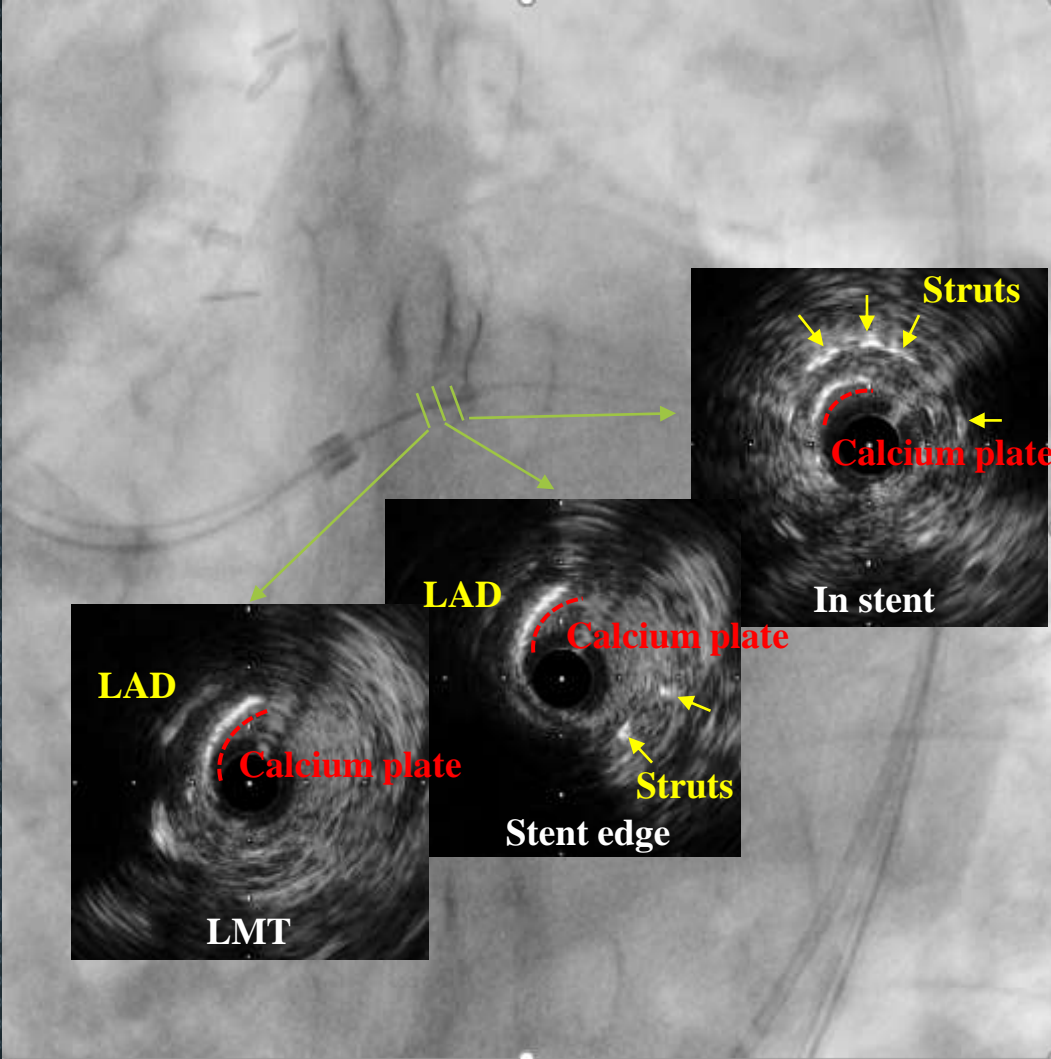
Case2: LAD in-stent CTO



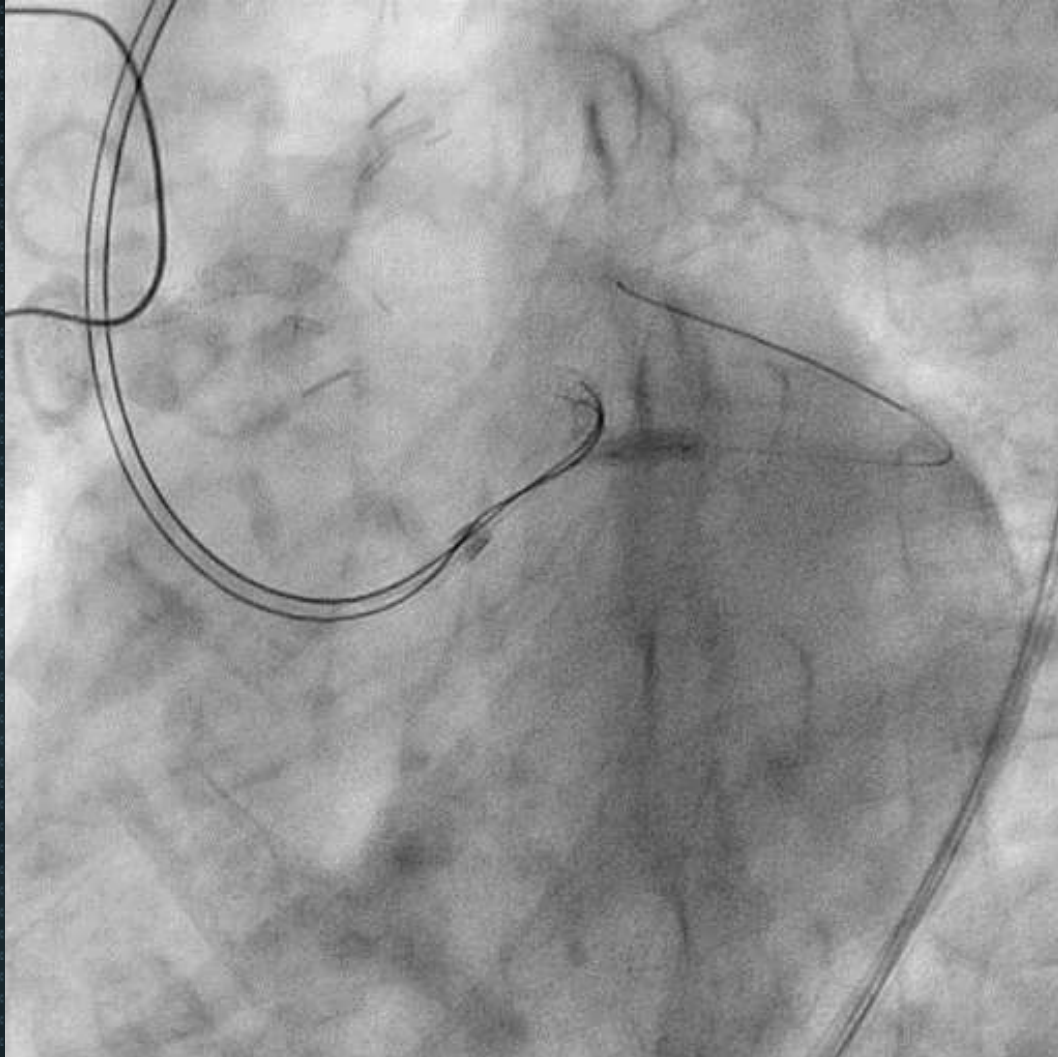
- ✓ GAIA Next 2 for LCX
- ✓ 1.5mm POBA → IVUS from LCX

Case2: LAD in-stent CTO

- ✓ GAIA Next 2 for LCX
- ✓ 1.5mm POBA→IVUS from LCX
- ✓ LAD os was jailed by protruded in-stent calcification.

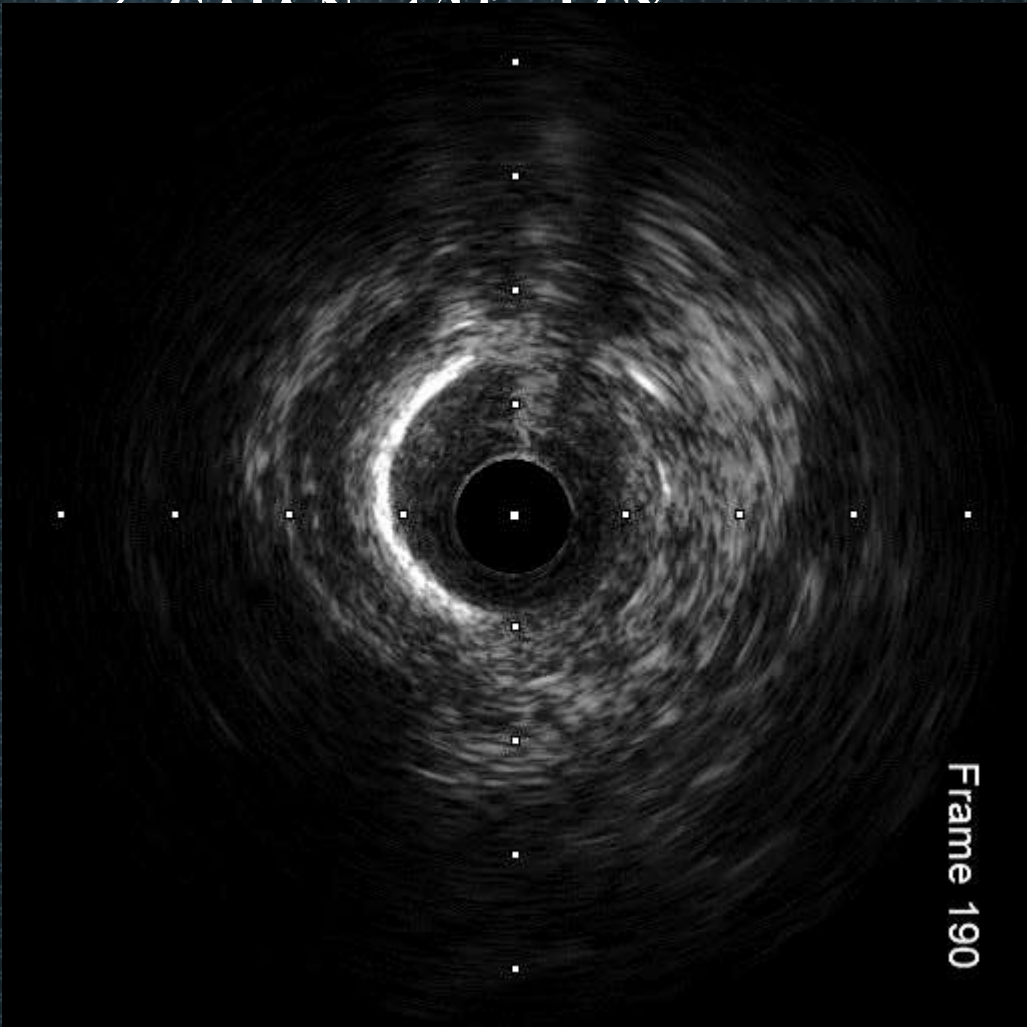
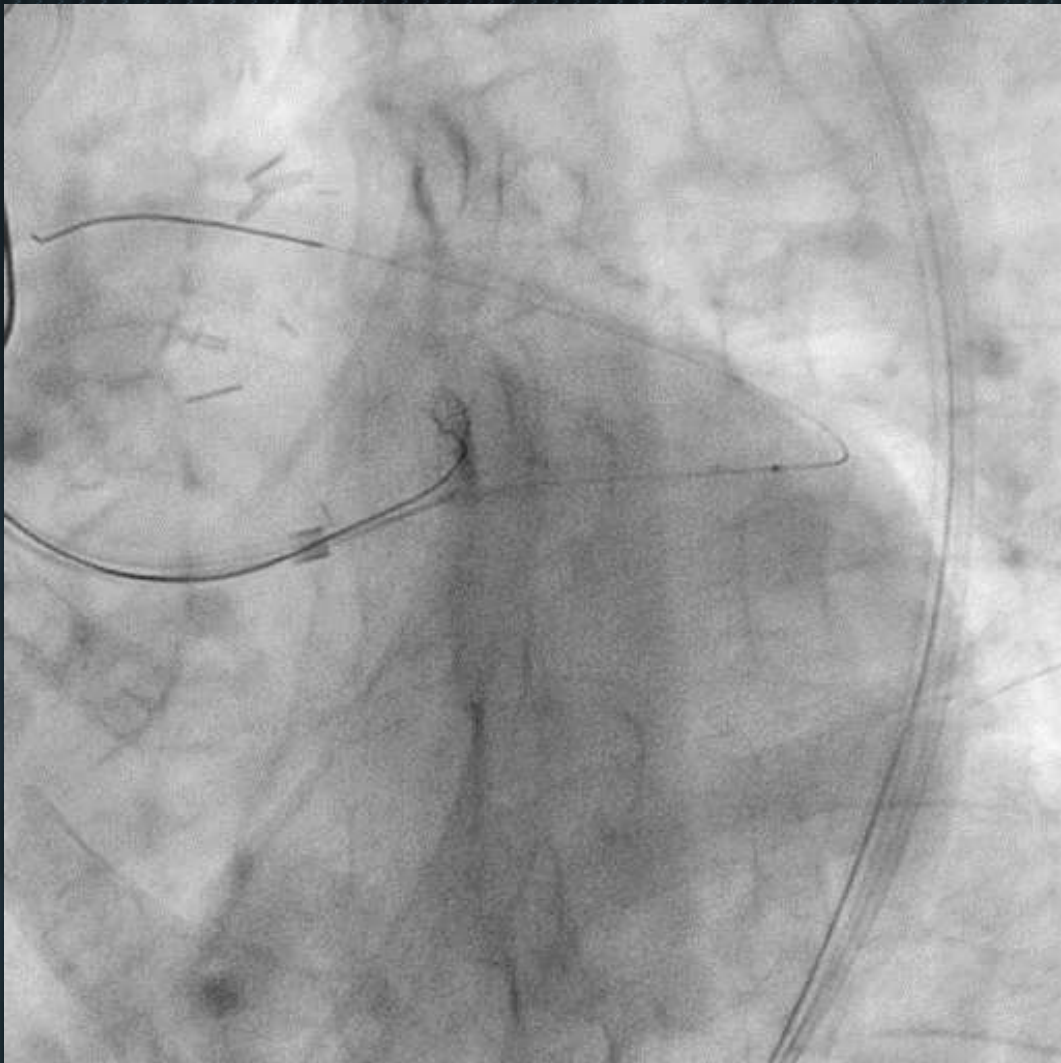


Case2: LAD in-stent CTO



- ✓ GAIA Next 2 for LCX
- ✓ 1.5mm POBA→IVUS from LCX
- ✓ LAD os was jailed by protruded in-stent calcification.
- ✓ Antegrade GW: Next2→Next 3→Conq12→Conq8-20→Conq9-40 with balloon anchoring
- ✓ Nothing could be passed.

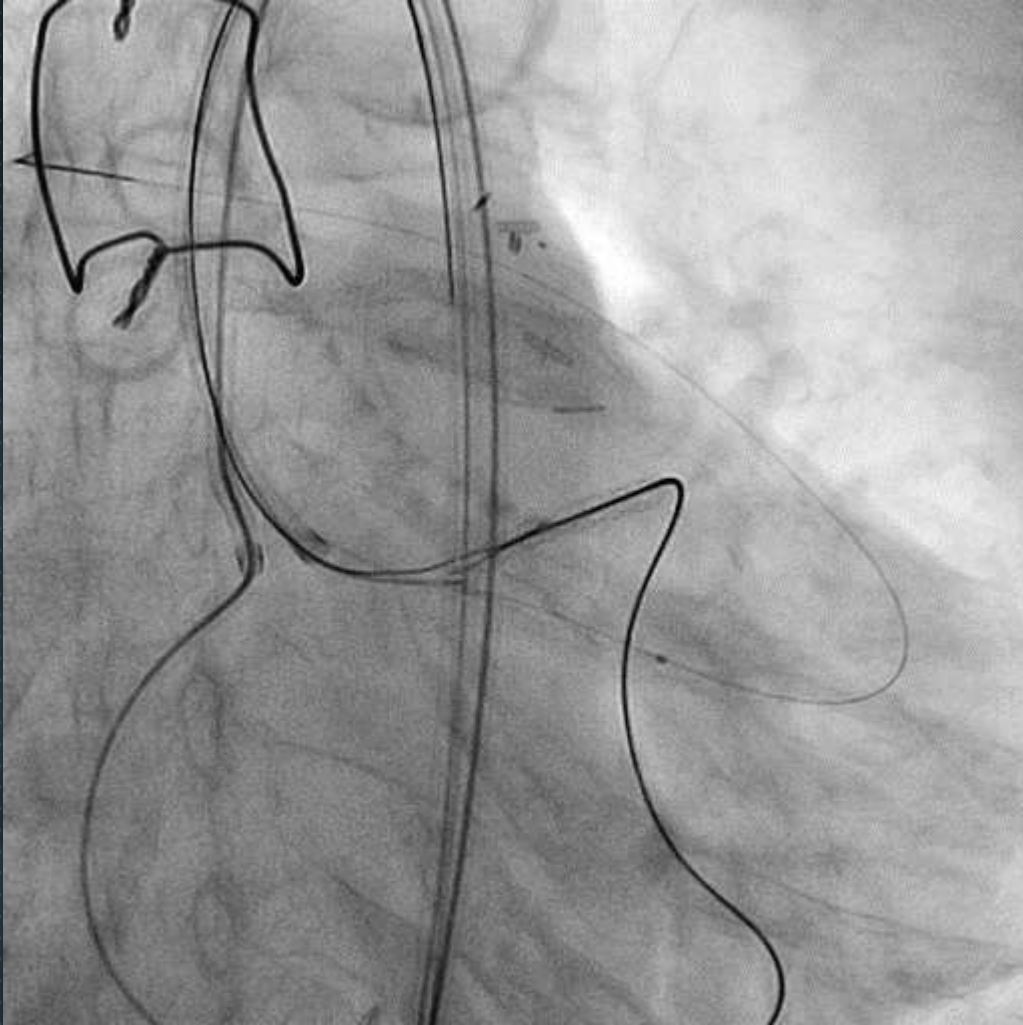
Case2: LAD in-stent CTO



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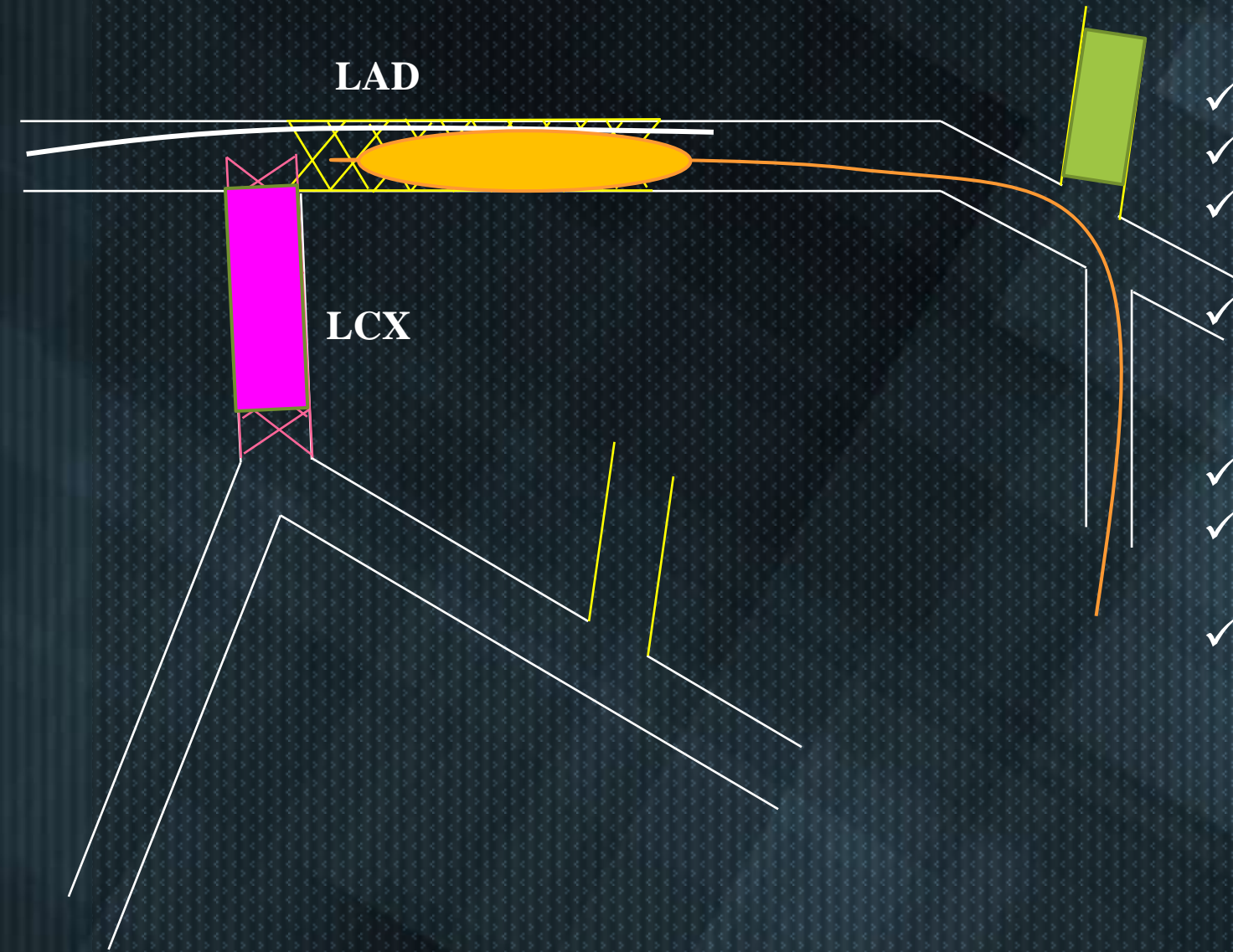
Frame 190

Case2: LAD in-stent CTO



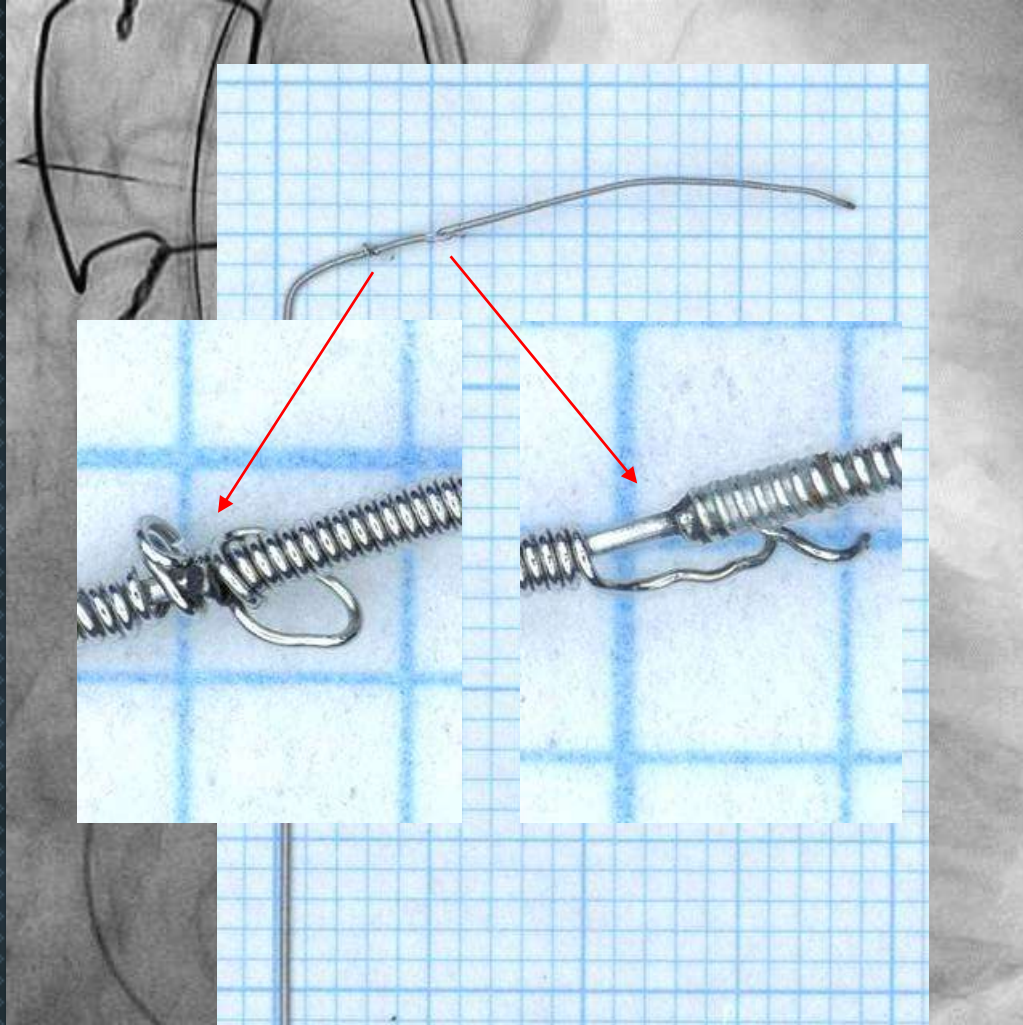
- ✓ GAIA Next 2 for LCX
- ✓ 1.5mm POBA→IVUS from LCX
- ✓ LAD os was jailed by protruded in-stent calcification.
- ✓ Antegrade GW: Next2→Next 3→Conq12→Conq8-20→Conq9-40 with balloon anchoring
- ✓ Nothing could be passed.
- ✓ Direct wire crossing from retrograde Conq12→ Conq8-20→Conq9-40

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- ✓ Balloon anchoring from retrograde in LAD stent to make better back-up support
- ✓ Antegrade GW (Conq9-40) was trapped

Summary

- **In-stent restenosis related CTO lesions are observed 10-15% in daily CTO procedure.**
- **In-stent CTO has less calcification but longer occlusion length compared with de-novo CTO.**
- **Overall procedural success rate is similar to de novo CTO**
- **However, it decreases in case with requiring retrograde approach.**
- **Calcified neo-atherosclerosis is observed in some old in-stent occlusion.**
- **Wire crossing is not easy for in-stent occlusion in bending vessel.**

CTO Club

The 19th Seminar of Angioplasty of Chronic Total Occlusions

Dates June 15 Fri. – 16 Sat., 2018

Venue WINC AICHI, Nagoya, Japan