

Breakfast Meeting #9 CTO 2006/4/28 Seoul Korea, Angioplasty Summit 2006



Image guided CTO-PCI

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Images for CTO-PCI

- Angiogram
 - Bi-plane, Bi-lateral injection
- IVUS
 - Identification of CTO entrance, segment
- MSCT
 - Pre procedure assessment
 - Reconfirmation anatomy during PCI



Image for CTO-PCI

- How to use IVUS
 - Identification of CTO entrance, segment
 - Bail out for wire cross trouble



Image for CTO-PCI: IVUS

- Case 1:
 - LAD ostium CTO
 - Identification of CTO entrance
 - Angiogram showed tapered CTO entrance
 - But real entrance is different.

CTO PCI

CTO entrance identification

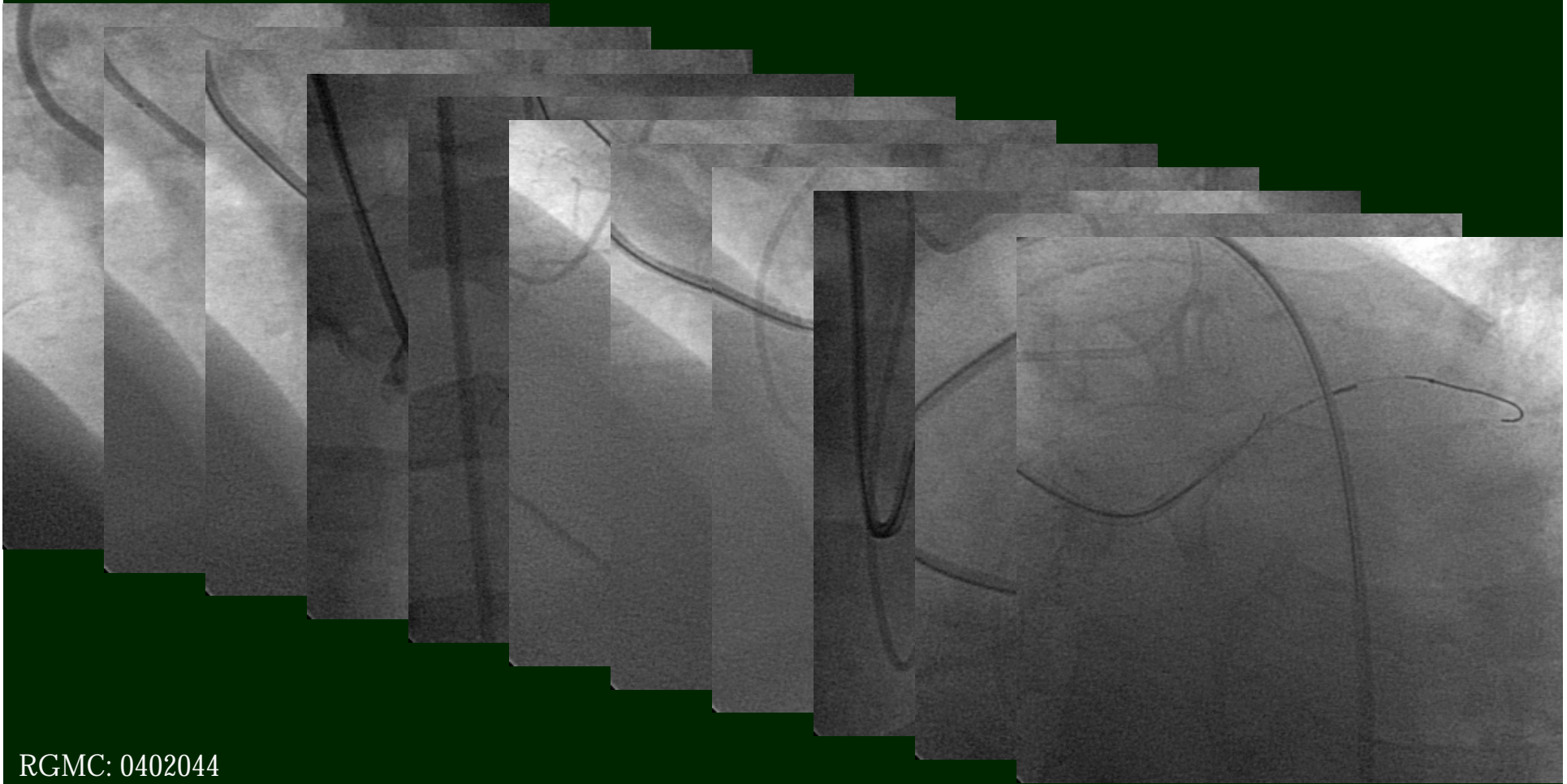


RGMC: 0402044

V:\Case2\NS LADos CTO IVUS LM ulcer

CTO PCI

CTO entrance identification

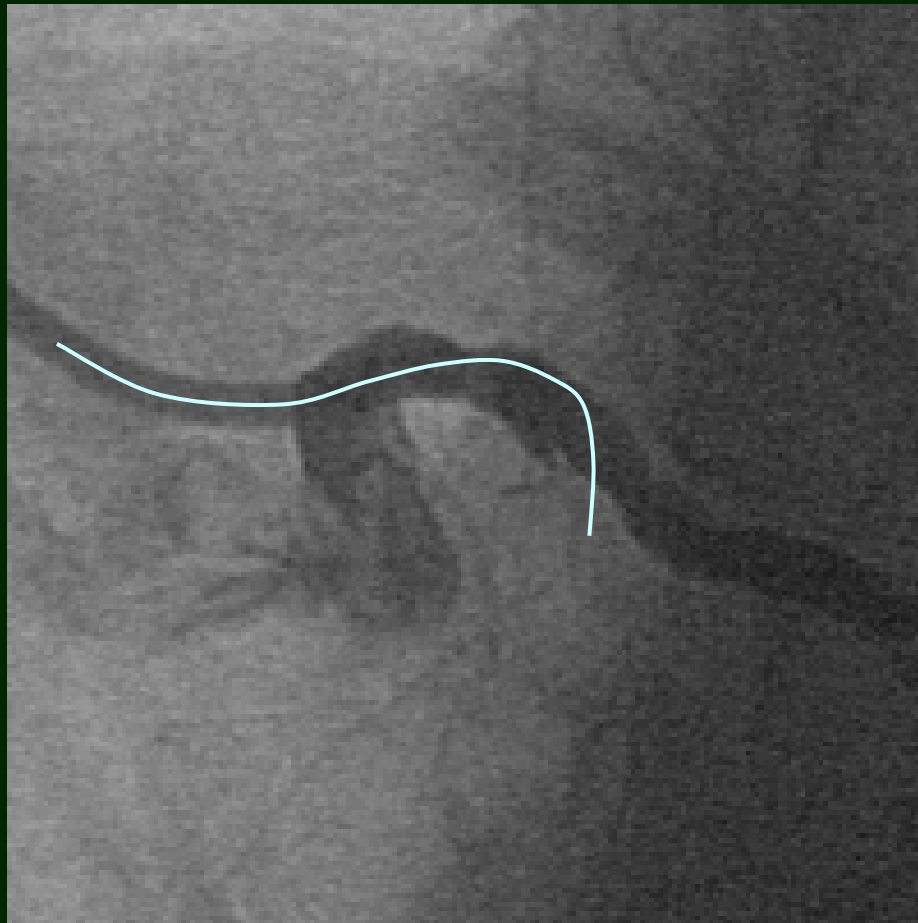


RGMC: 0402044

V:\Case2\NS LADos CTO IVUS LM ulcer

CTO PCI

CTO entrance identification

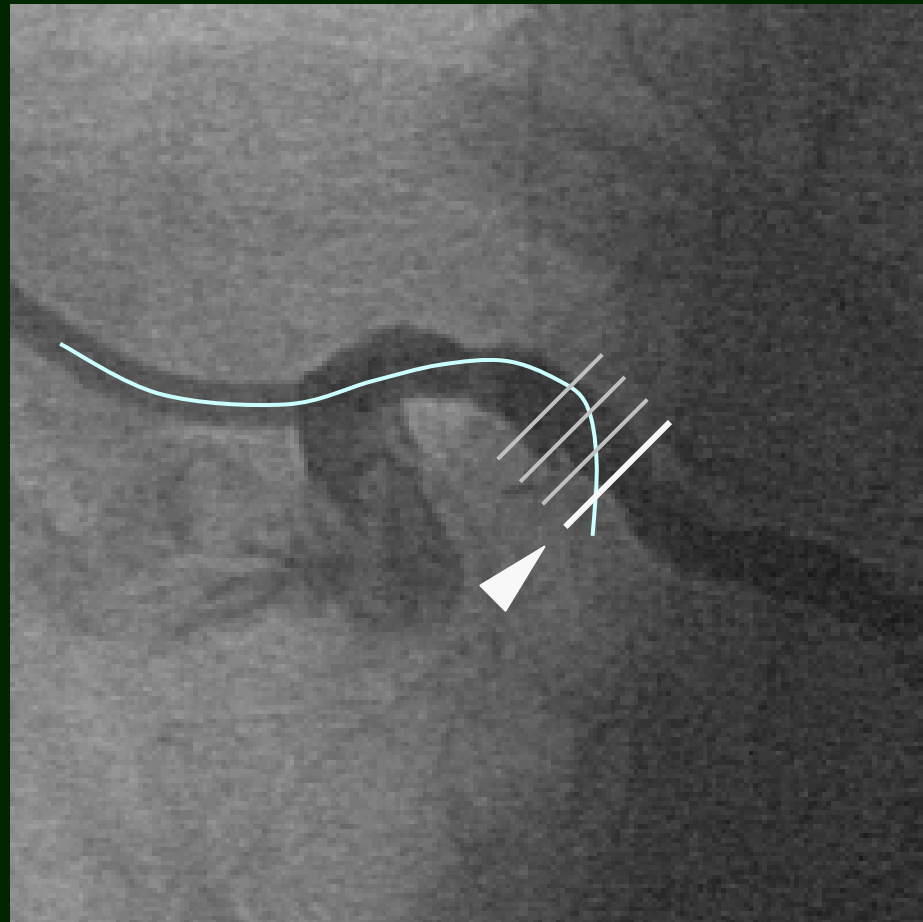


RGMC: 0402044

V:\Case2\NS LADos CTO IVUS LM ulcer

CTO PCI

CTO entrance identification



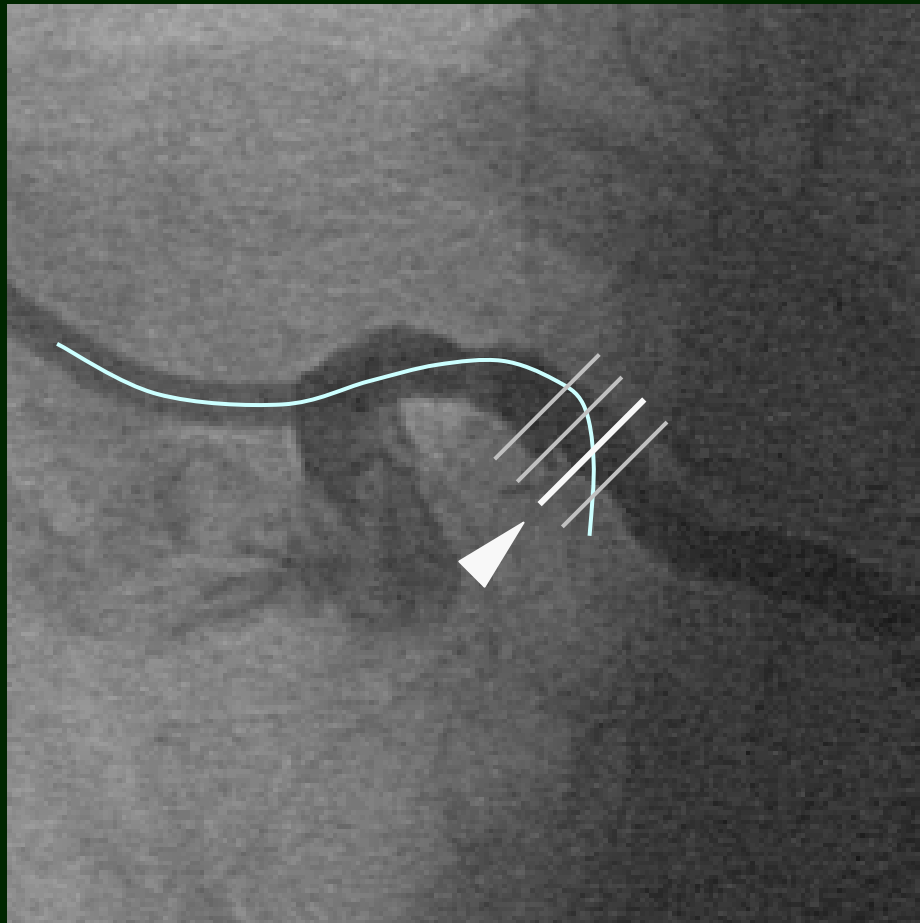
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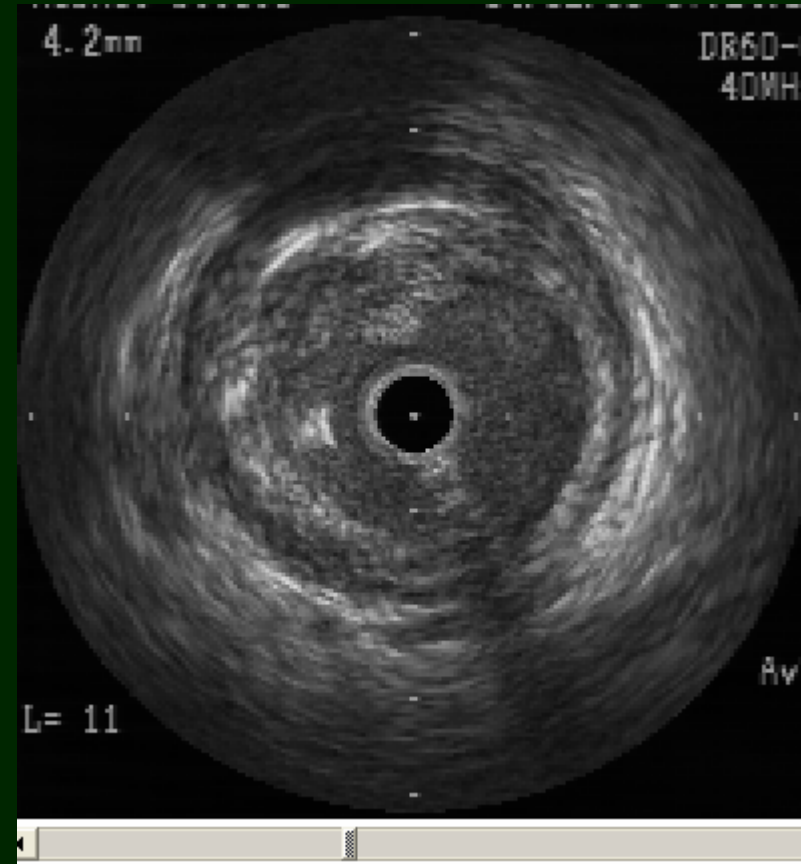
V:\Case2\NS LADos CTO IVUS LM ulcer

CTO PCI

CTO entrance identification



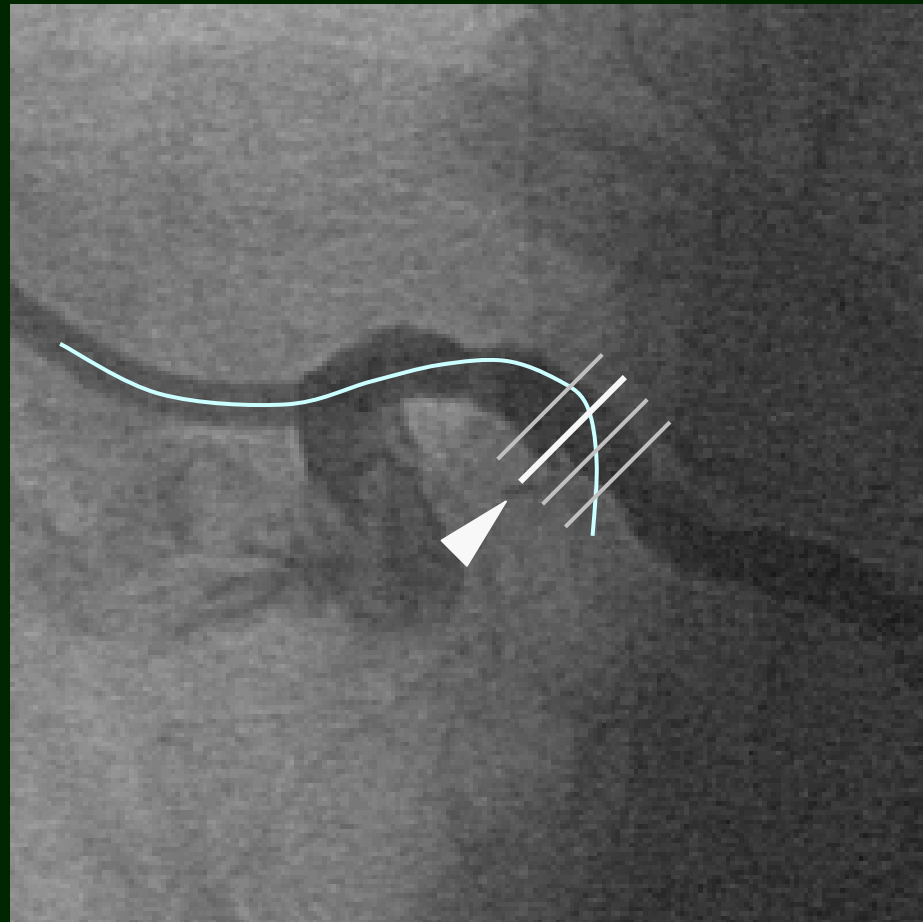
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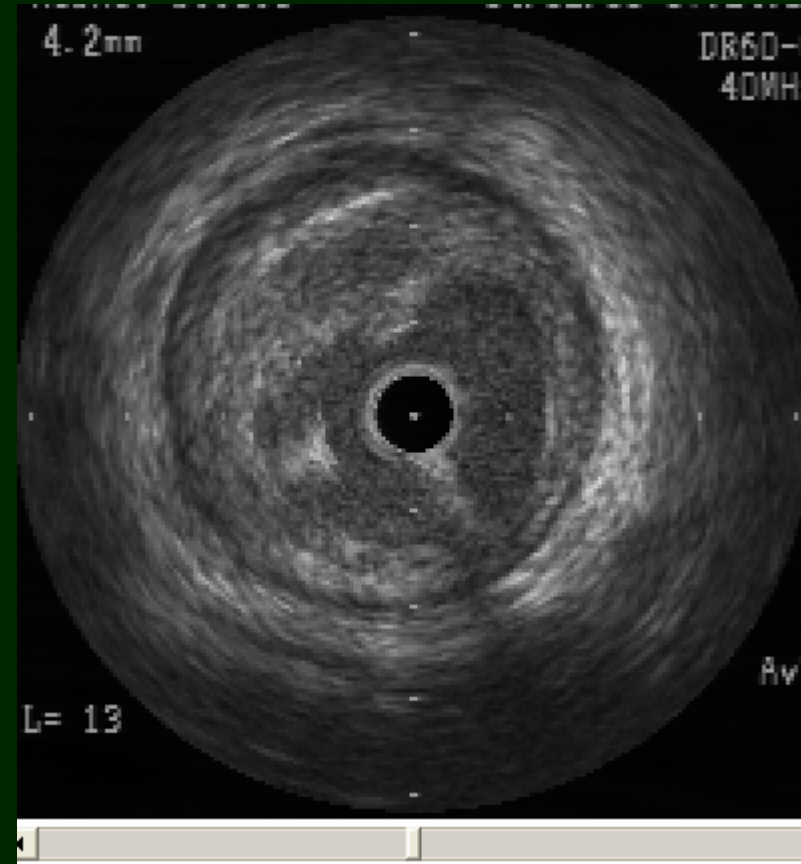
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CTO PCI

CTO entrance identification



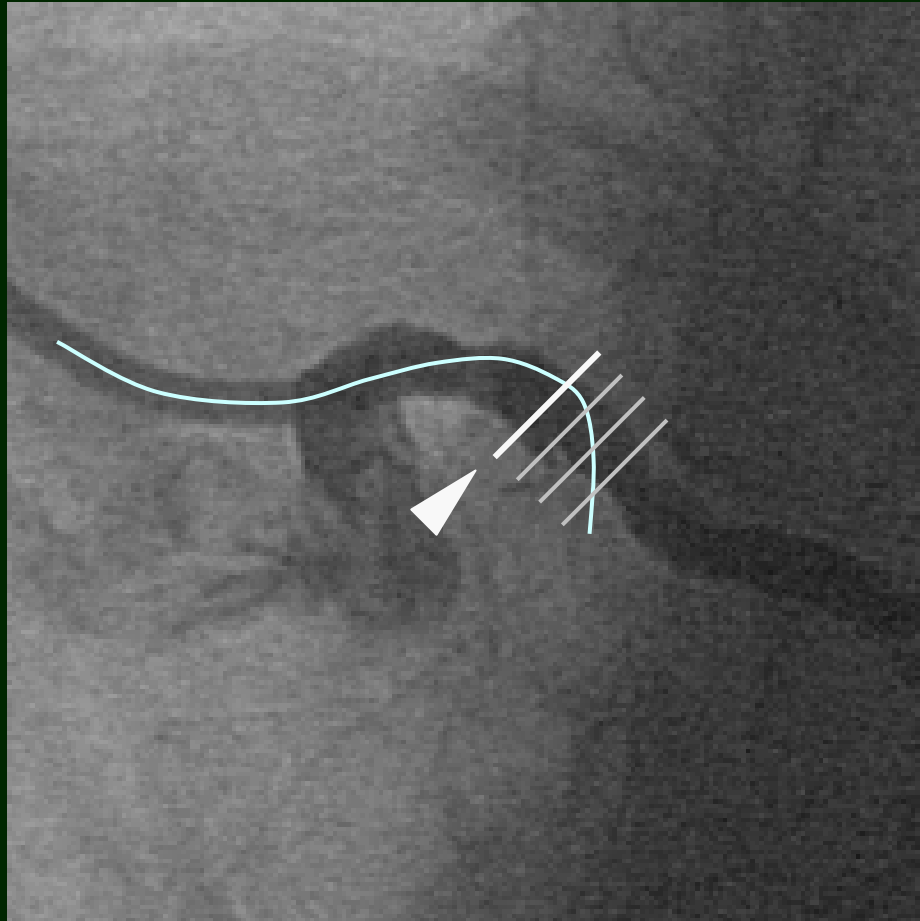
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CTO PCI

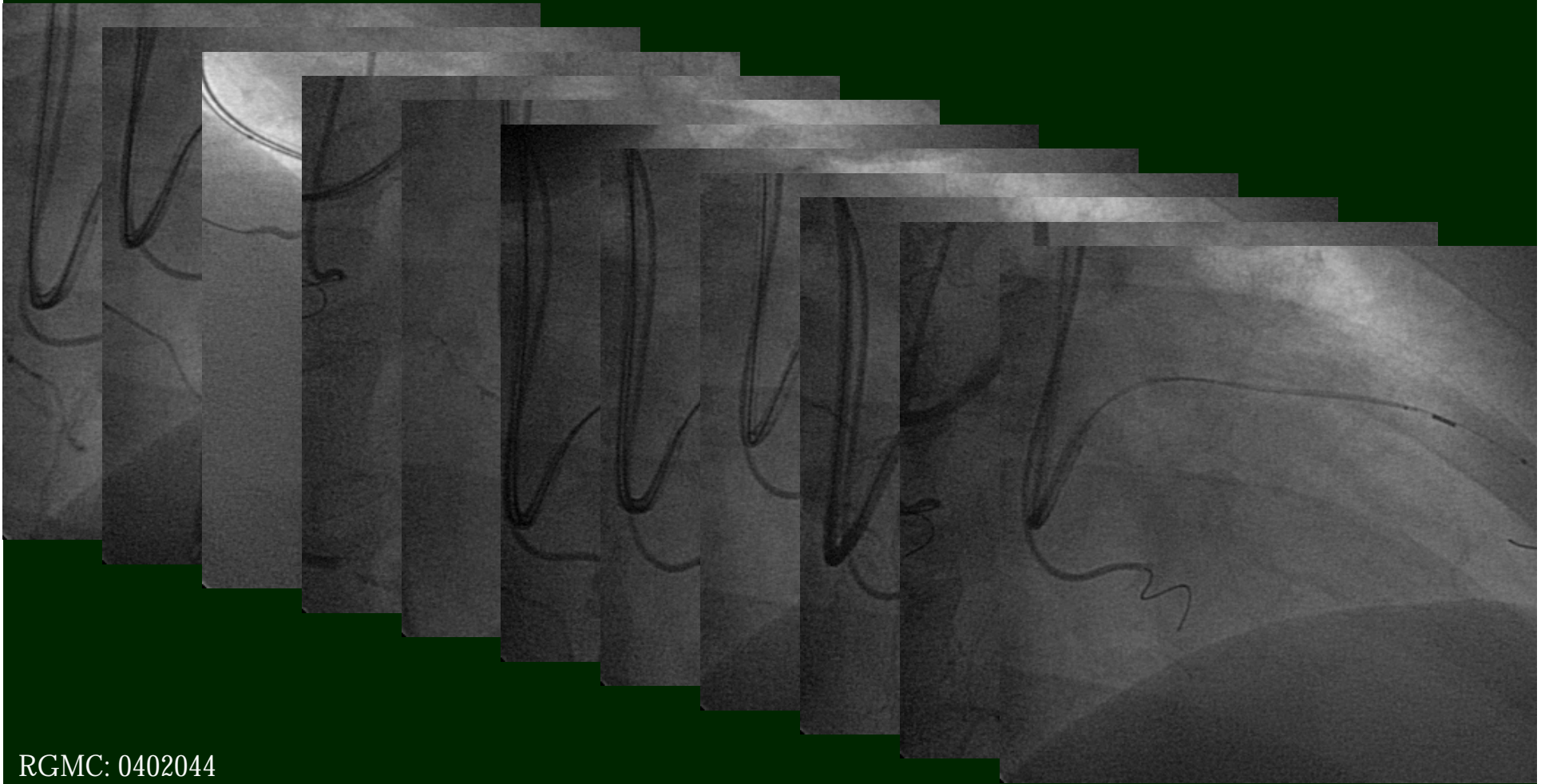
CTO entrance identification



RGMC: 0402044

CTO PCI

CTO entrance identification & wire cross support



RGMC: 0402044

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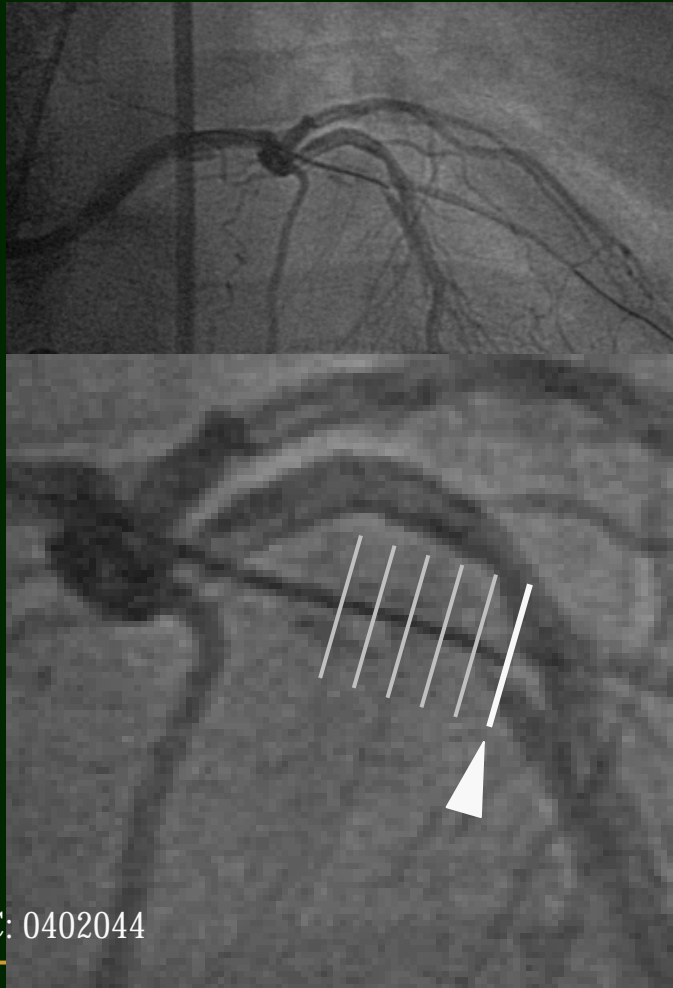


Image for CTO-PCI: IVUS

- Case 1 (contd.):
 - Difficulty in wire recross branch to distal LAD
 - Bail out for wire cross trouble

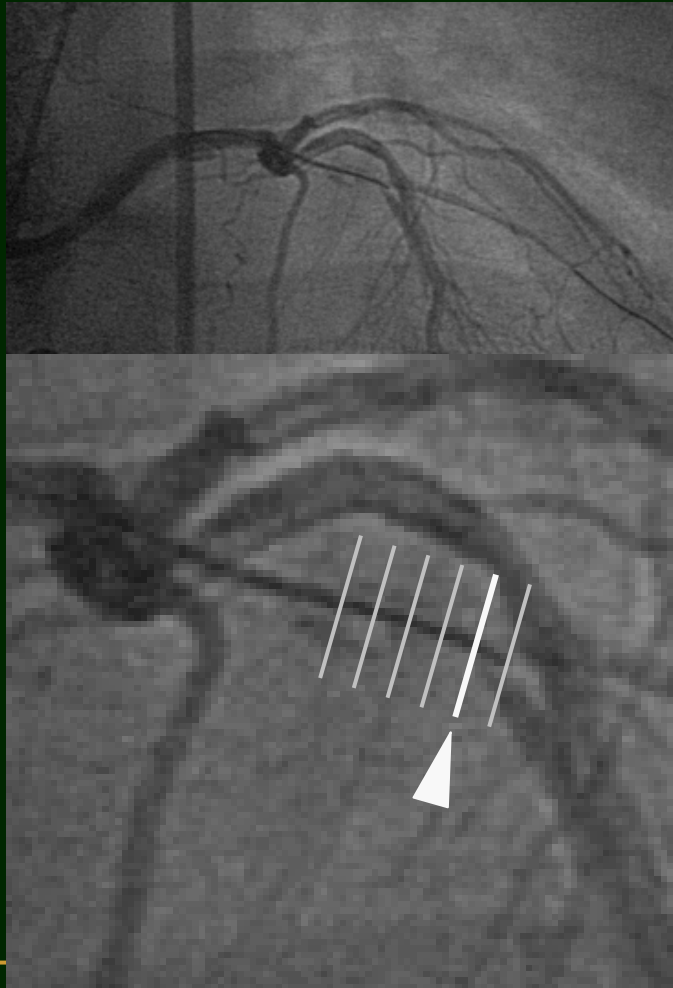
CTO PCI

CTO entrance identification & wire cross support



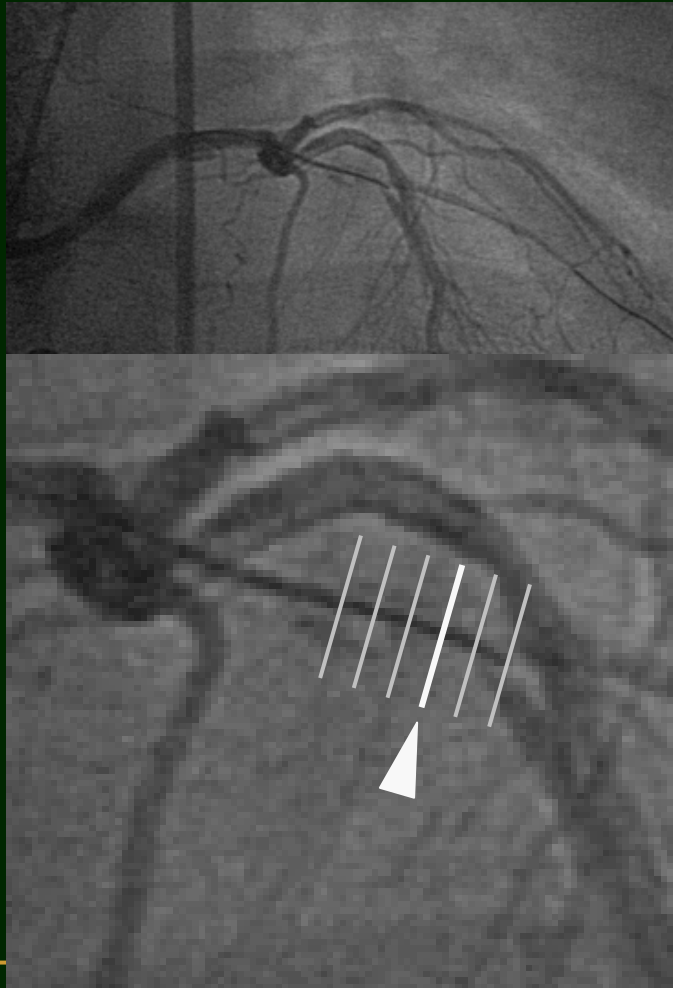
CTO PCI

CTO entrance identification & wire cross support



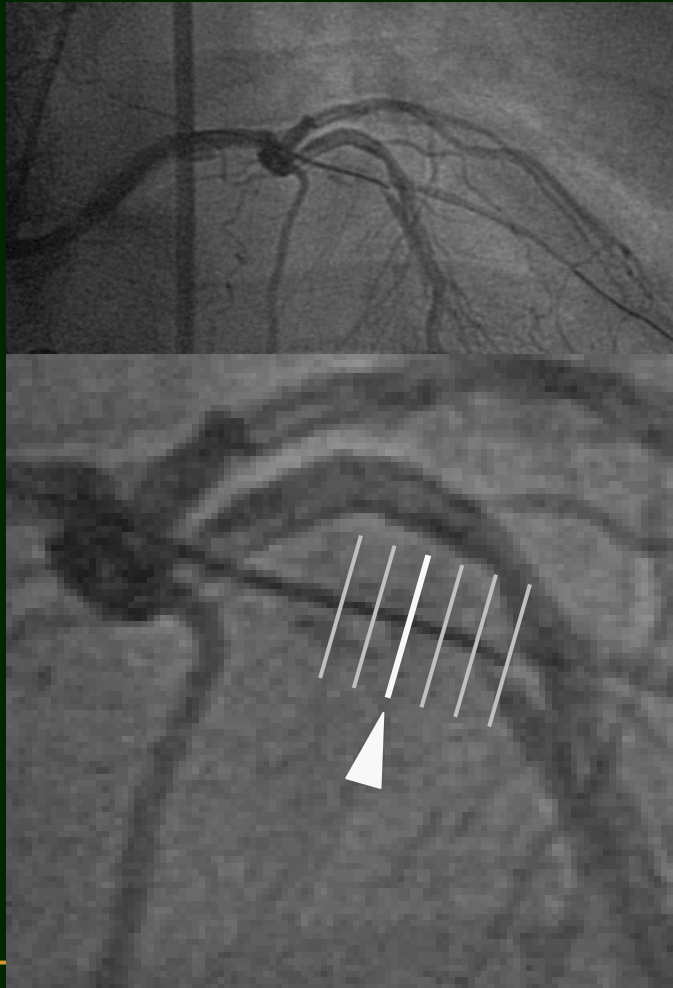
CTO PCI

CTO entrance identification & wire cross support



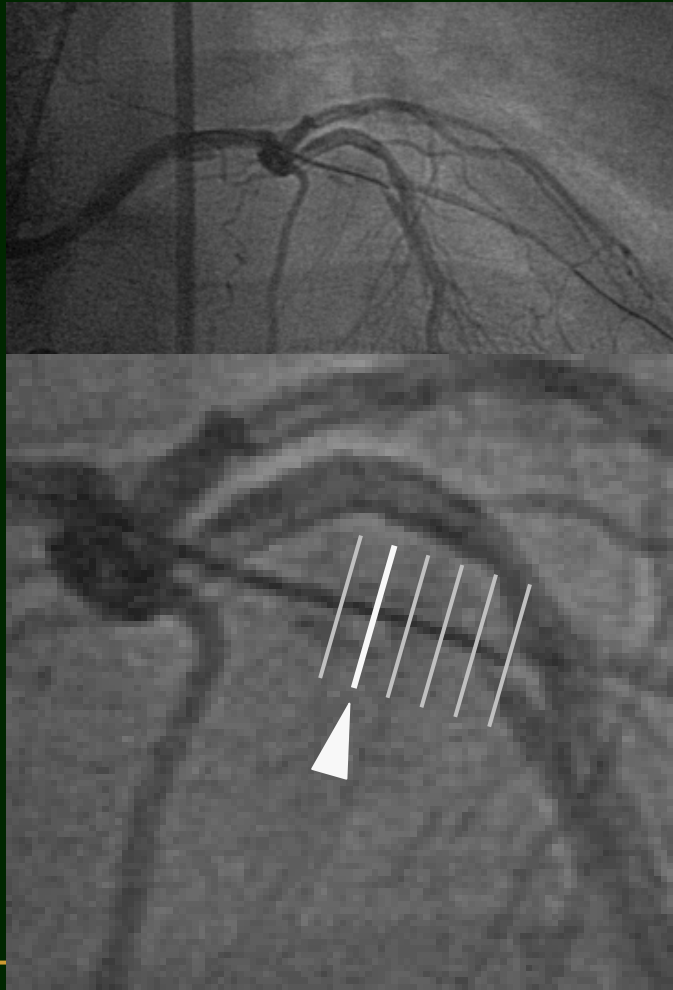
CTO PCI

CTO entrance identification & wire cross support



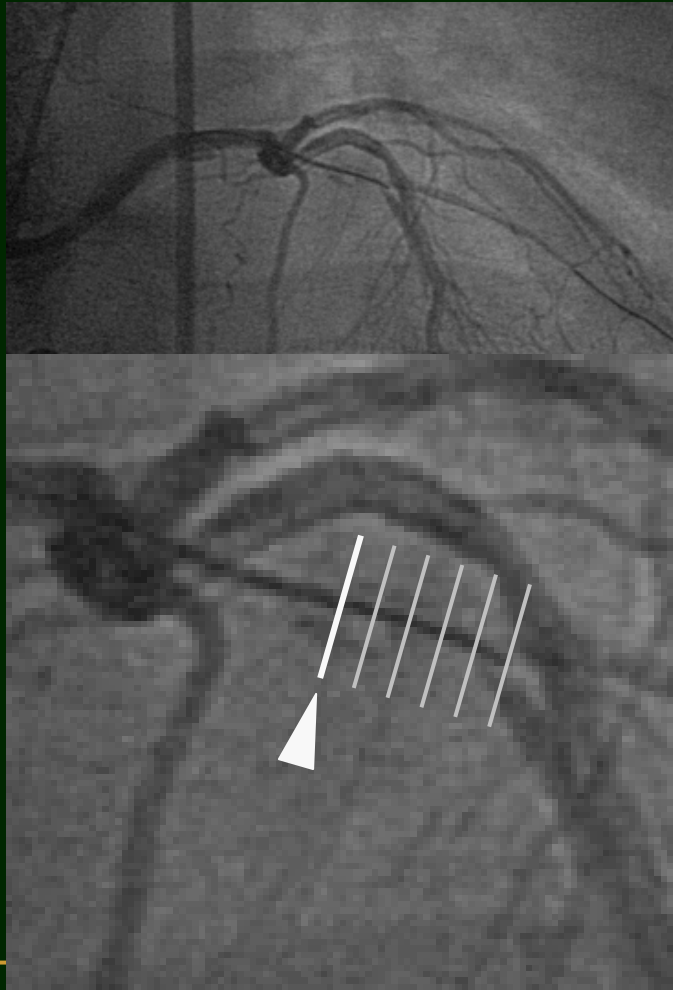
CTO PCI

CTO entrance identification & wire cross support



CTO PCI

CTO entrance identification & wire cross support



CTO PCI

CTO entrance identification & wire cross support

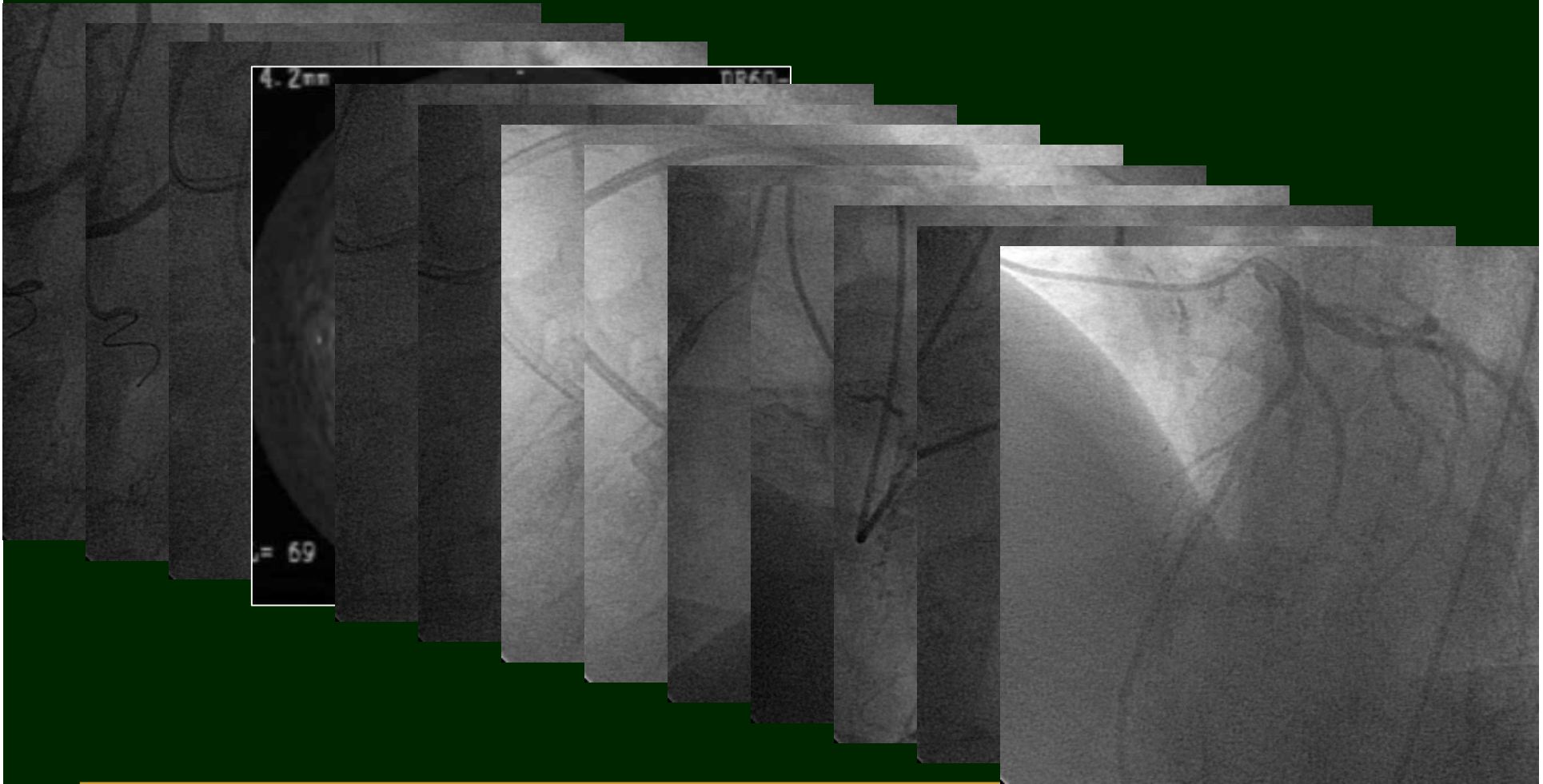




Image for CTO-PCI: IVUS

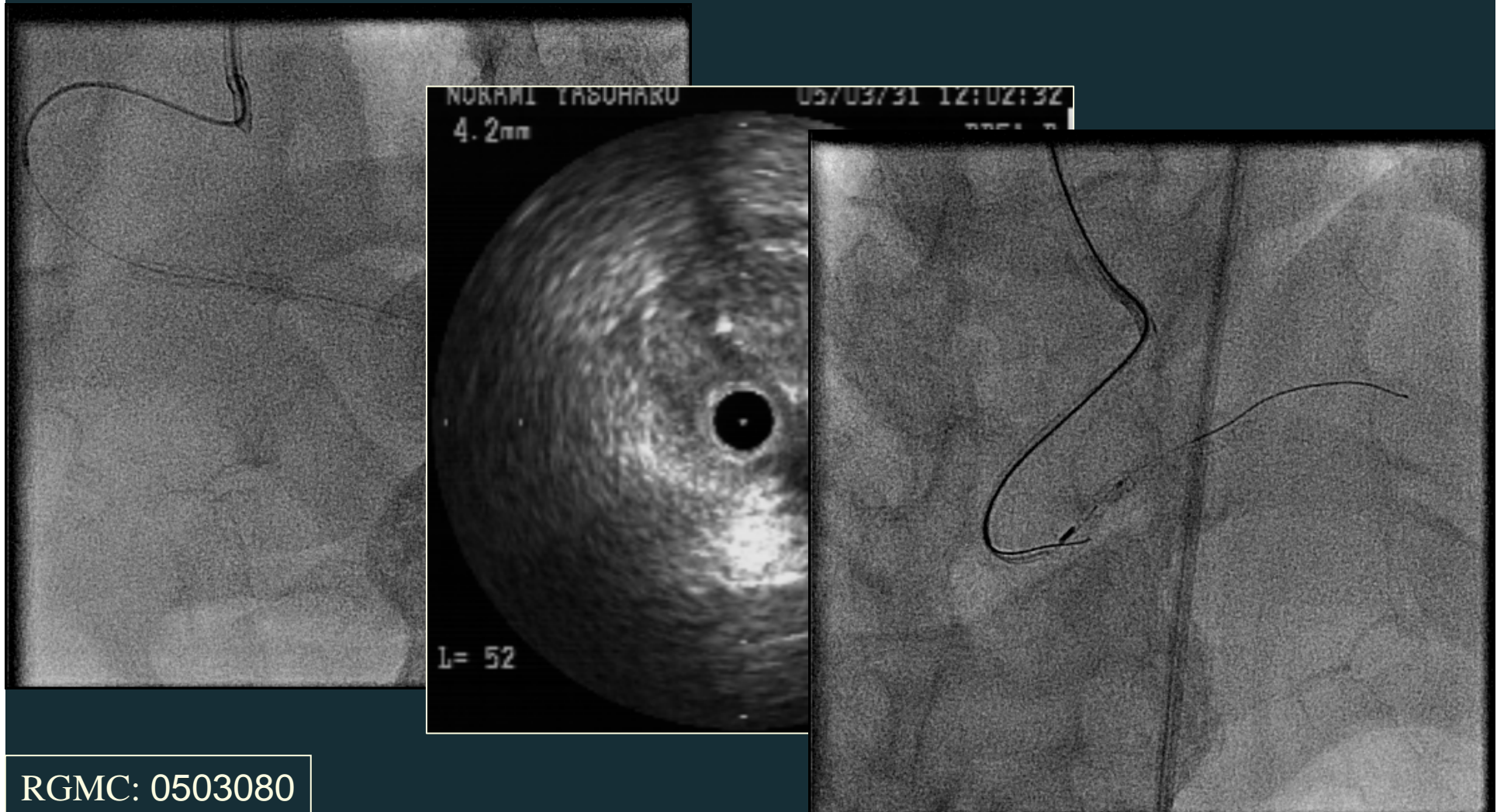
- Case 2:
 - RCA stent reoccluded CTO
 - Identification of CTO segment
 - IVUS showed that IVUS was out of occluded stent.

Case; RCA stent reoccluded lesion



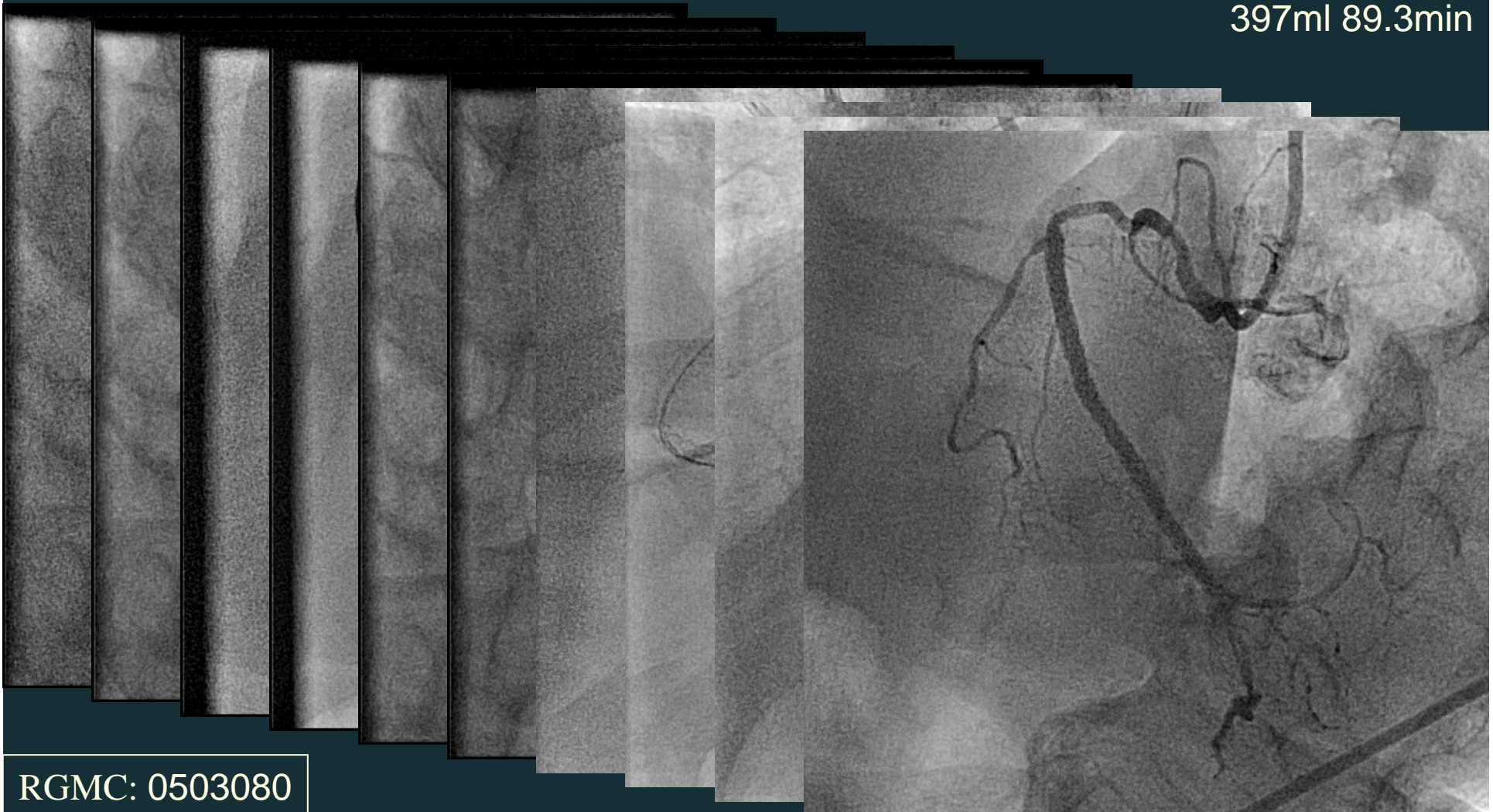
RGMC: 0503080

Case; RCA stent reoccluded lesion



Case; RCA stent reoccluded lesion

397ml 89.3min



RGMC: 0503080

Image for CTO-PCI

How to use MSCT for CTO-PCI

- MSCT
 - Pre procedure assessment
 - Anatomy, size, calcium contain
 - Collateral condition
 - Grading of CTO
 - Reconfirmation anatomy during PCI
 - Simultaneous check in cathlabo monitor

Rinku Protocol of Heart CT

- GE Light Speed 16 (16*0.625, 0.4sec)
- Pre med; β - blocker (+), Nitro (+)
- Contrast use; <100ml
- Breath holding; \approx 20sec
- GE Advantage Workstation 4.2
- Angiogram and IVUS -like view
 - Thin slice MIP (maximum intensity projection)
 - 5mm in LCA and 10mm in RCA
 - MPR (multiple planner reconstruction)



Patient Stats

■ **Visualization:**

- 40 cases with known angiographic CTO lesions (total 45 lesions).
 - July 2004 – Apr 2005
- exclusions: arrhythmia (Af, VPC), breath holding difficulty

■ **Applicability:**

- Heart CT group: 34 cases, received CTO-PCI with CT data
 - July 2004 – June 2005
 - Control group: 26 cases, received CTO-PCI without CT data
 - Jan 2004 – June 2005
 - 3 cases crossed over from Control to Heart CT group after failed 1st CTO-PCI.
-

Result: Visualization

45 unrevascularized CTOs in 40 cases

visible = 43 CTOs (95.6%)

Bending, calcium, vessel size, entry direction

invisible = 2 CTO (4.4%)

68yo Male, CTO in mid LAD

Same intensity CTO segment and surrounding tissue

CTO in myocardium?

57yo Male, CTO in mid-distal RCA

Poor image

Result: Applicability for CTO-PCI

Lesion and Procedure success rate: 57 CTO-PCIs (2004/1-2005/6)

	CT	#	Lesion success	#	1 st Proc. success
CTO	+	34	94.1% (32/34)	31	87.1% (27/31)
	-	23	82.6% (19/23)	26	69.2% (18/26)

Cross over CT(-) to CT(+): 3 cases >> successfully revascularized.

Result: Applicability for CTO-PCI

Radiation exposure: 56 1st CTO-PCIs (2004/1-2005/6)

* 2 missing data was excluded

	CT	#	average	<i>median</i>	SD	min	max
CTO	+	31	45.8	32.4	28.2	18.3	122
	-	24*	55.1	49.6	22.2	19.5	97.9

CAG's Radiation exposure and Contrast medium: mean (median) \pm SD

Single plane = 13.6 (11.6) \pm 9.0 min & 120.1 (118) \pm 39.1 ml

Bi plane = 13.2 (12.0) \pm 7.8 min & 87.1 (83) \pm 35.9 ml

Summary

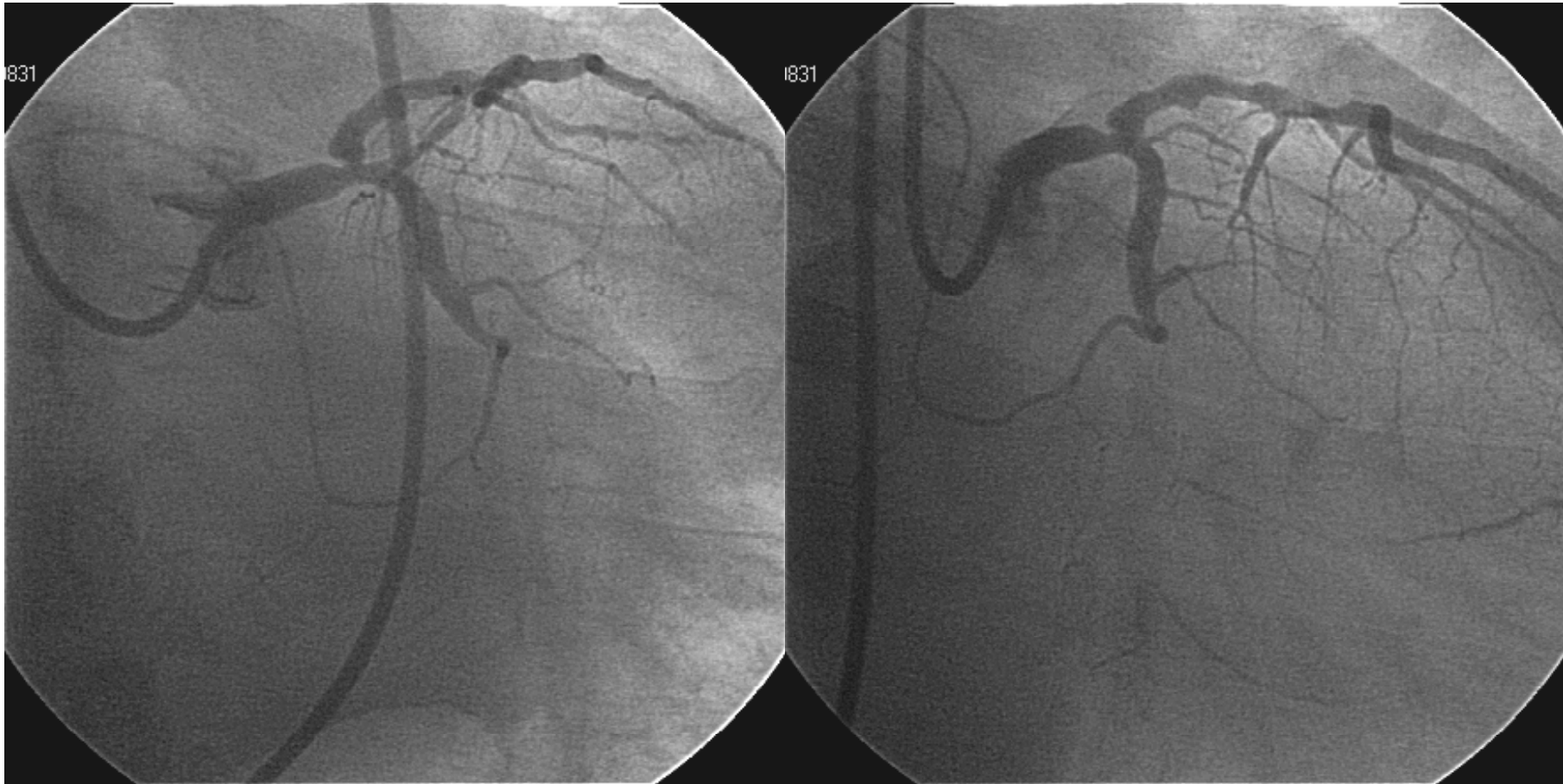
- We evaluated that the detectability and applicability of 16 slices MSCT for PCI in CTO (Chronic Total Occluded) lesions.
 - The detectability of CTO lesion was 95.6%.
 - The success rate of CTO-PCI with MSCT was 94.1% in final and 87.1% in first procedure, which were quite better than the success rate without MSCT of 82.6% and 69.2%, respectively.
-



Image for CTO-PCI: MSCT

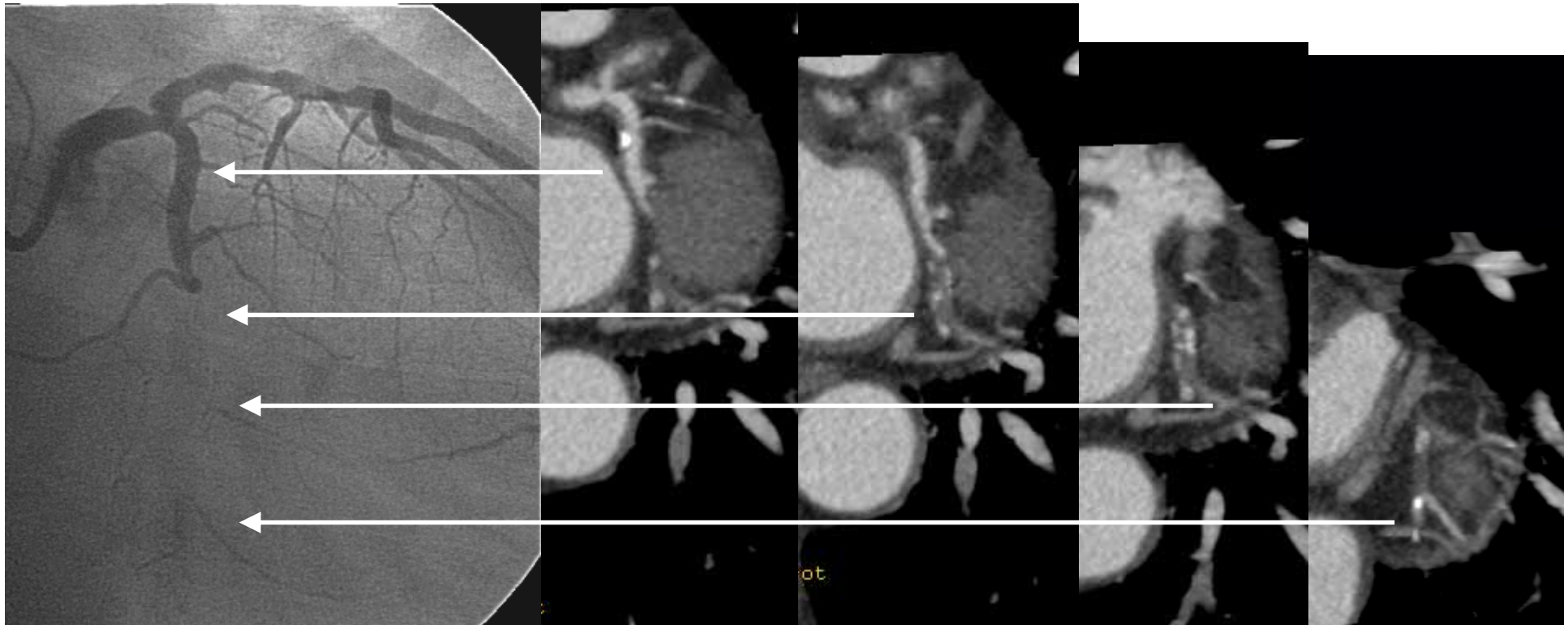
- Case 3:
 - Mid LCX CTO
 - MSCT showed accurate direction of CTO segment.

Case 1: MSCT supported PCI

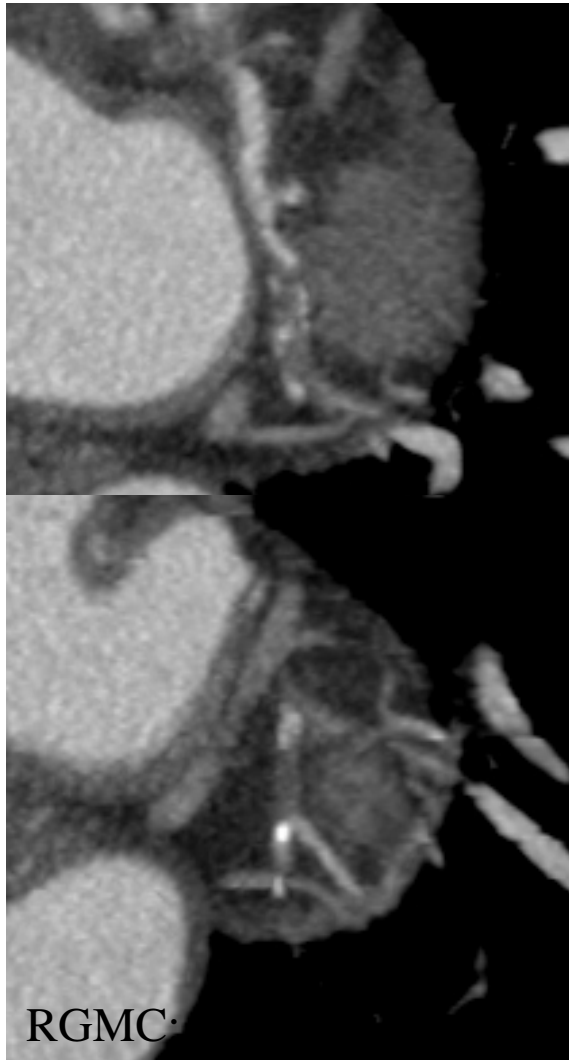


RGMC: 0408107

Case 1: MSCT supported PCI

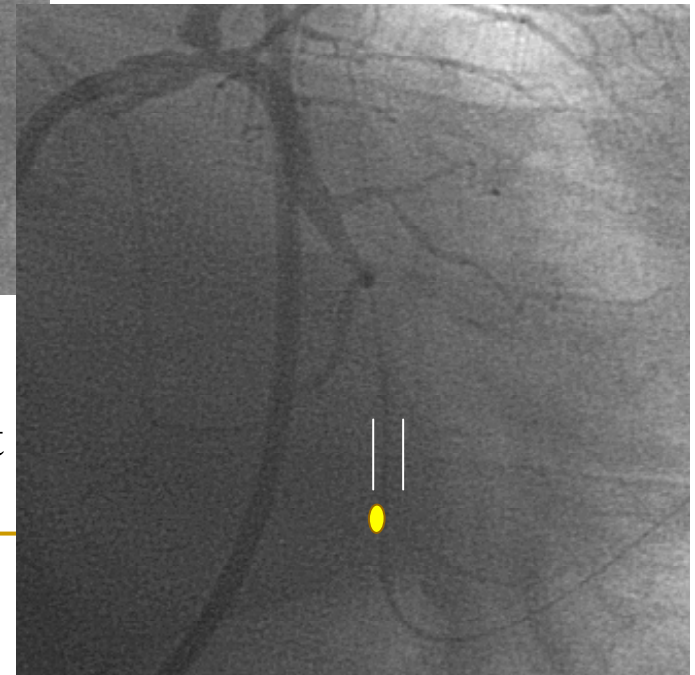


Case 1: MSCT supported PCI



Direction of CTO segment
Calcium location

Vessel size in CTO segment
Calcium location



Case 1: MSCT supported PCI

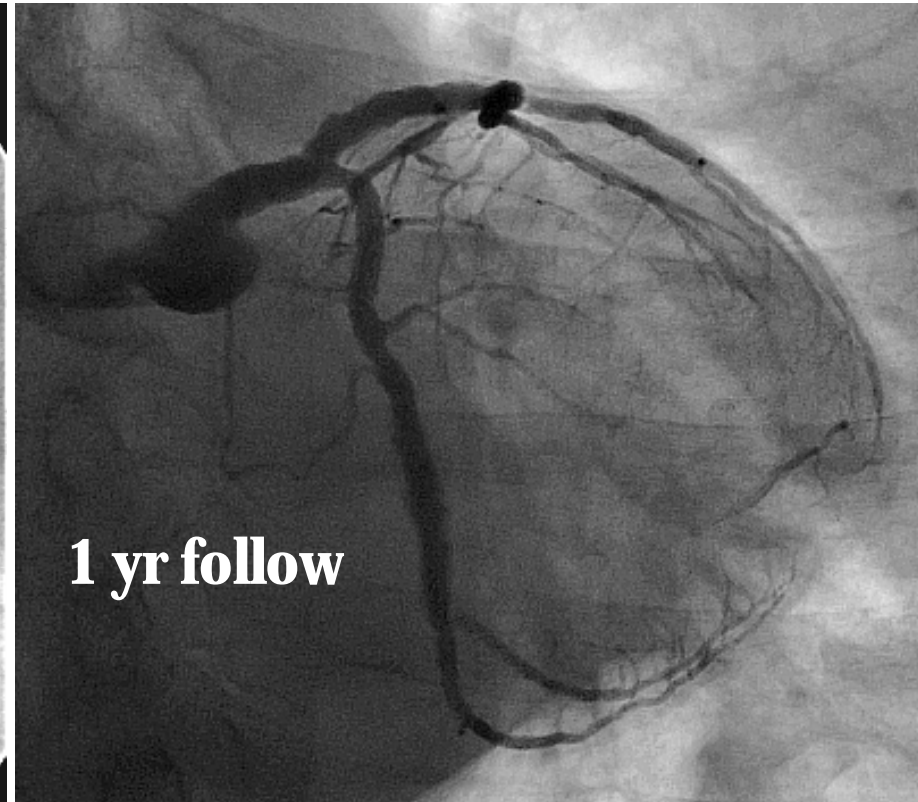
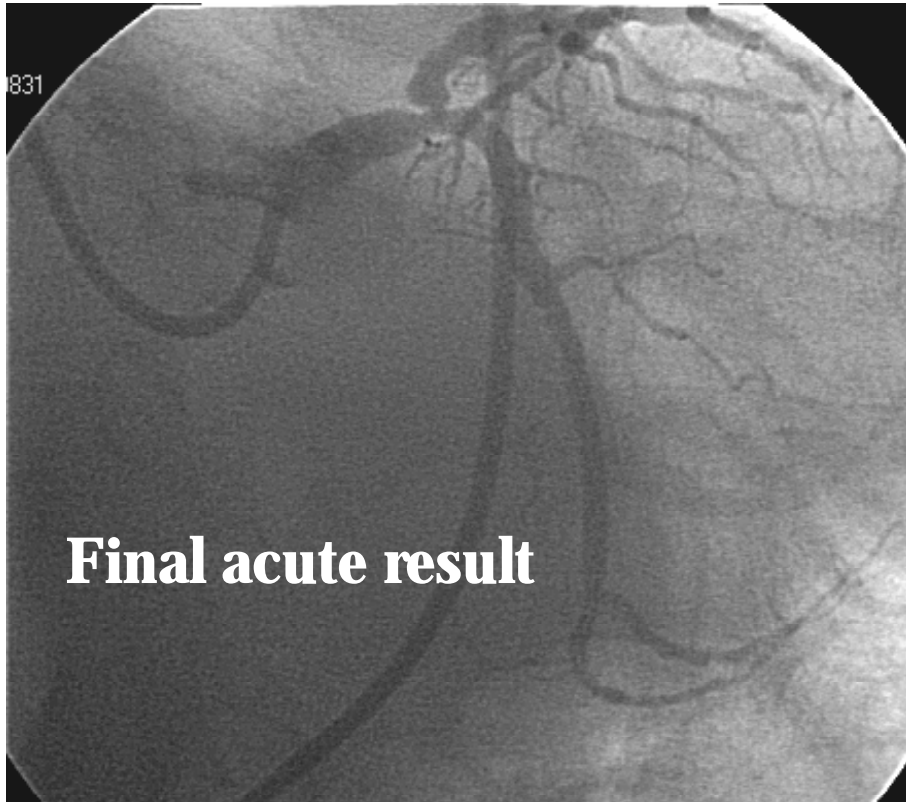




Image for CTO-PCI: MSCT

- Case 4:
 - CTO in proximal RCA with bridge collateral.
 - CT showed that the size of RCA is big and the lumen should be not bridge collateral but micro channel in the plaque.
 - IVUS confirmed that the lumen was micro-channel after small size ballooning.

Case 2: MSCT supported PCI micro-channel/collateral assessment



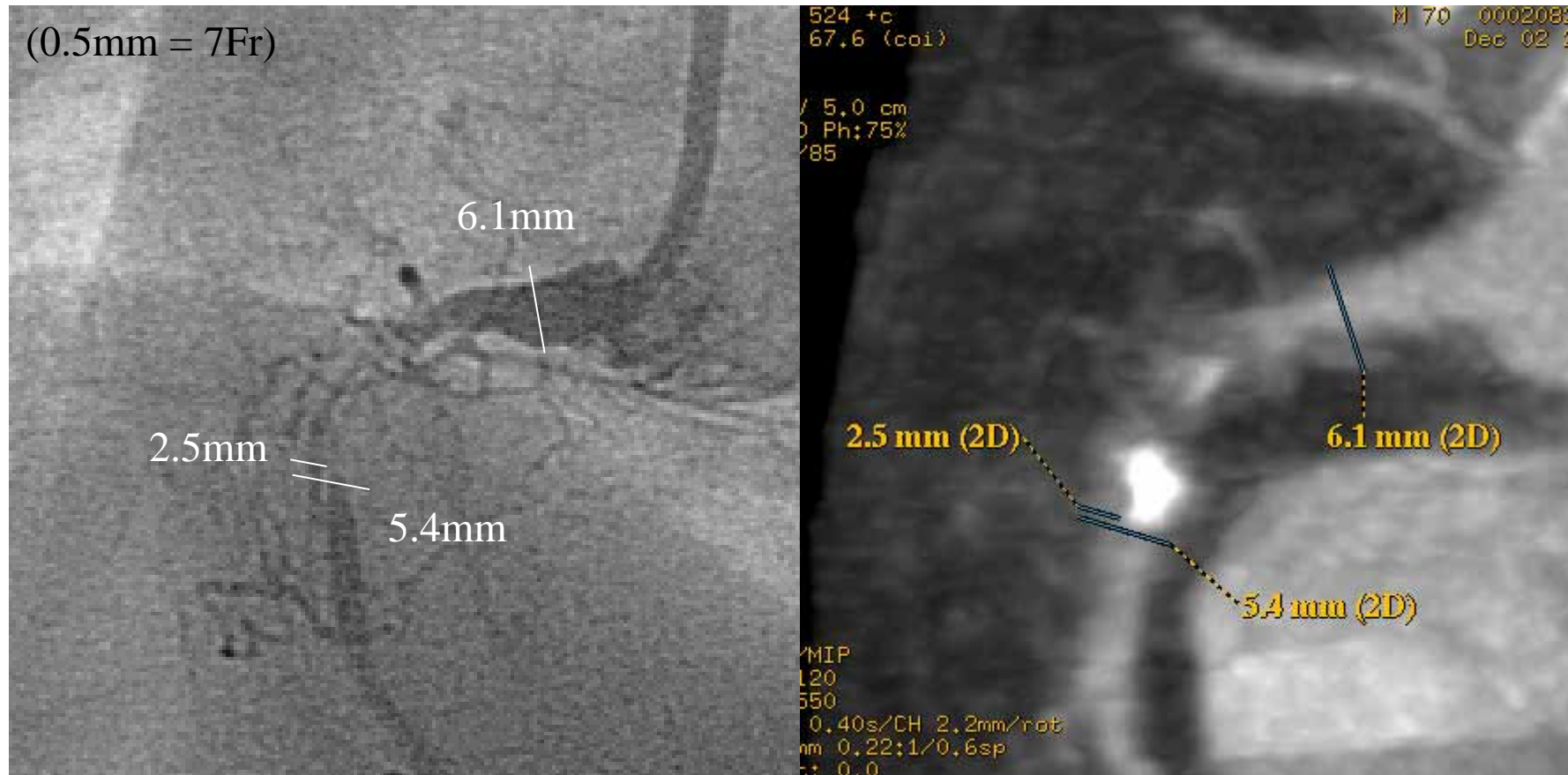
Case 2: MSCT supported PCI micro-channel/collateral assessment



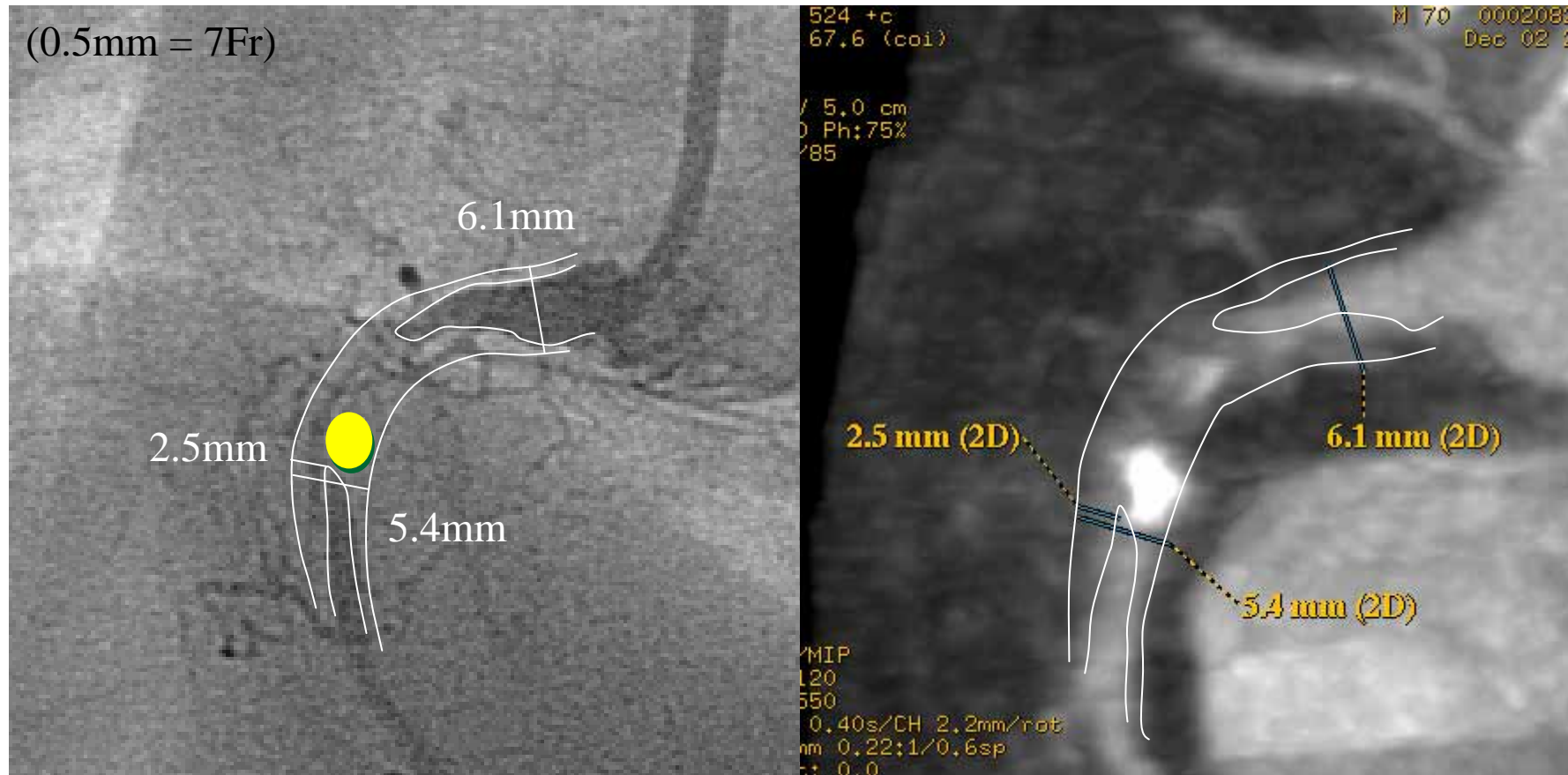
Case 2: MSCT supported PCI micro-channel/collateral assessment



Case 2: MSCT supported PCI micro-channel/collateral assessment



Case 2: MSCT supported PCI micro-channel/collateral assessment



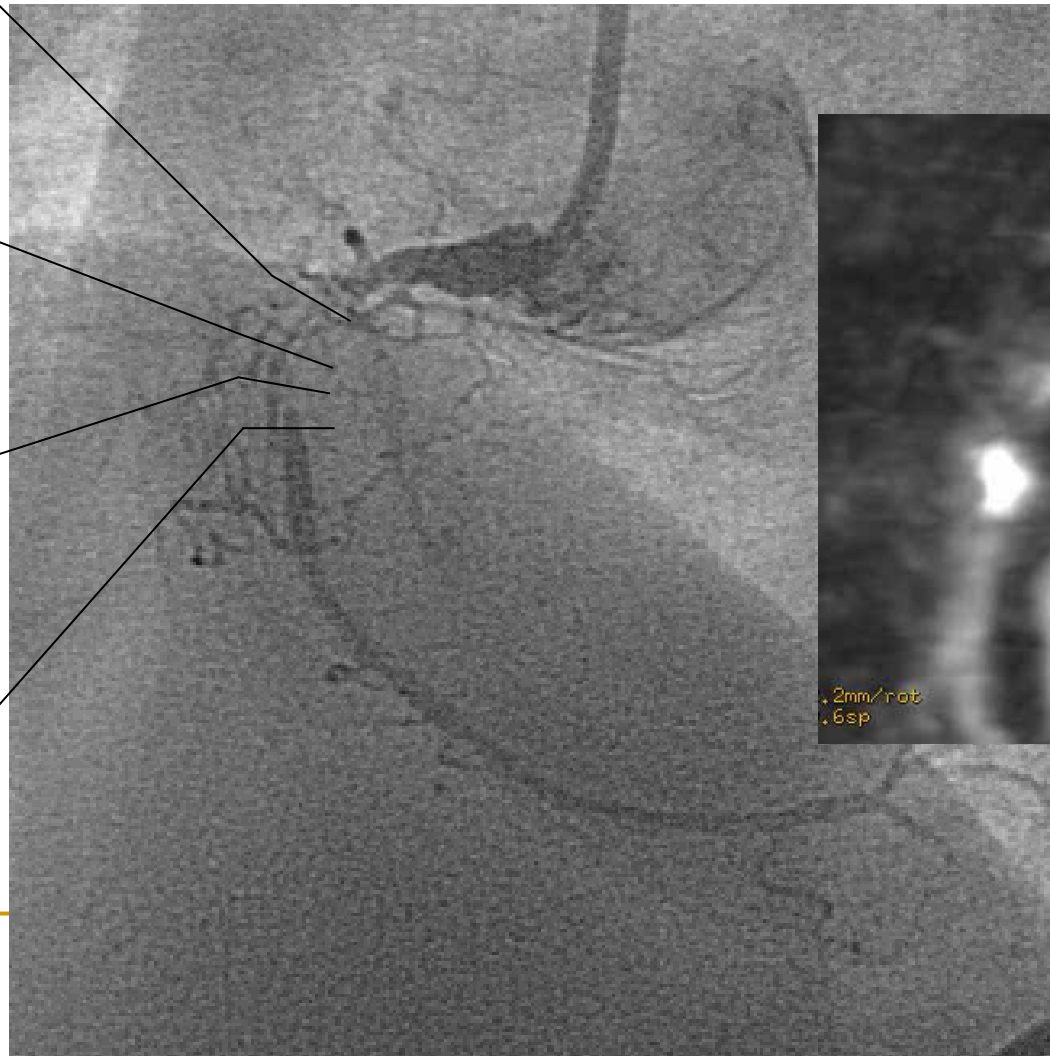
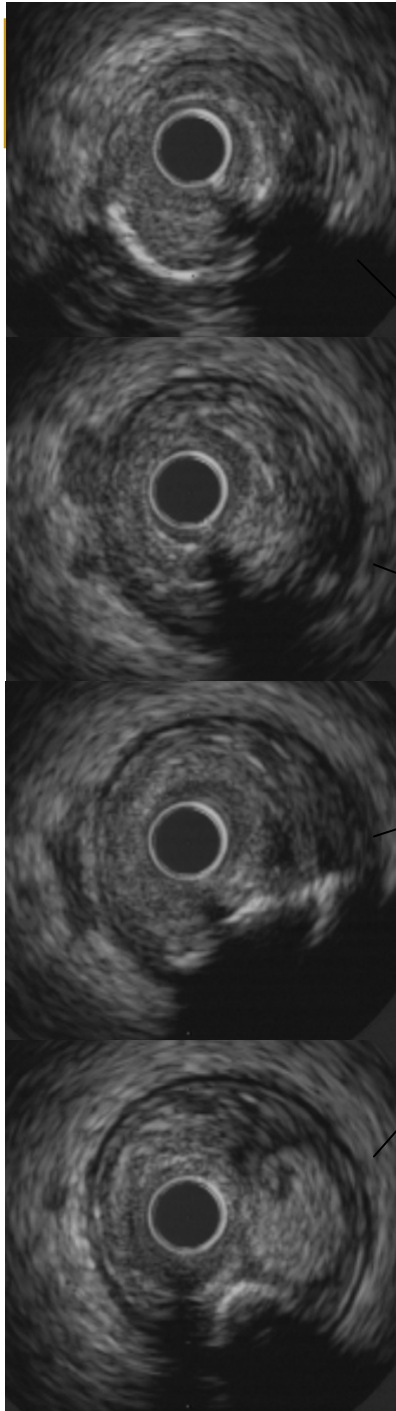
Case 2: MSCT supported PCI

micro-channel/collateral assessment



RGMC: 0412043 & 0502022

Case 4: MSCT supported PCI micro-channel/collateral assessment



.2mm/rot
.6sp

Case 2: MSCT supported PCI

micro-channel/collateral assessment

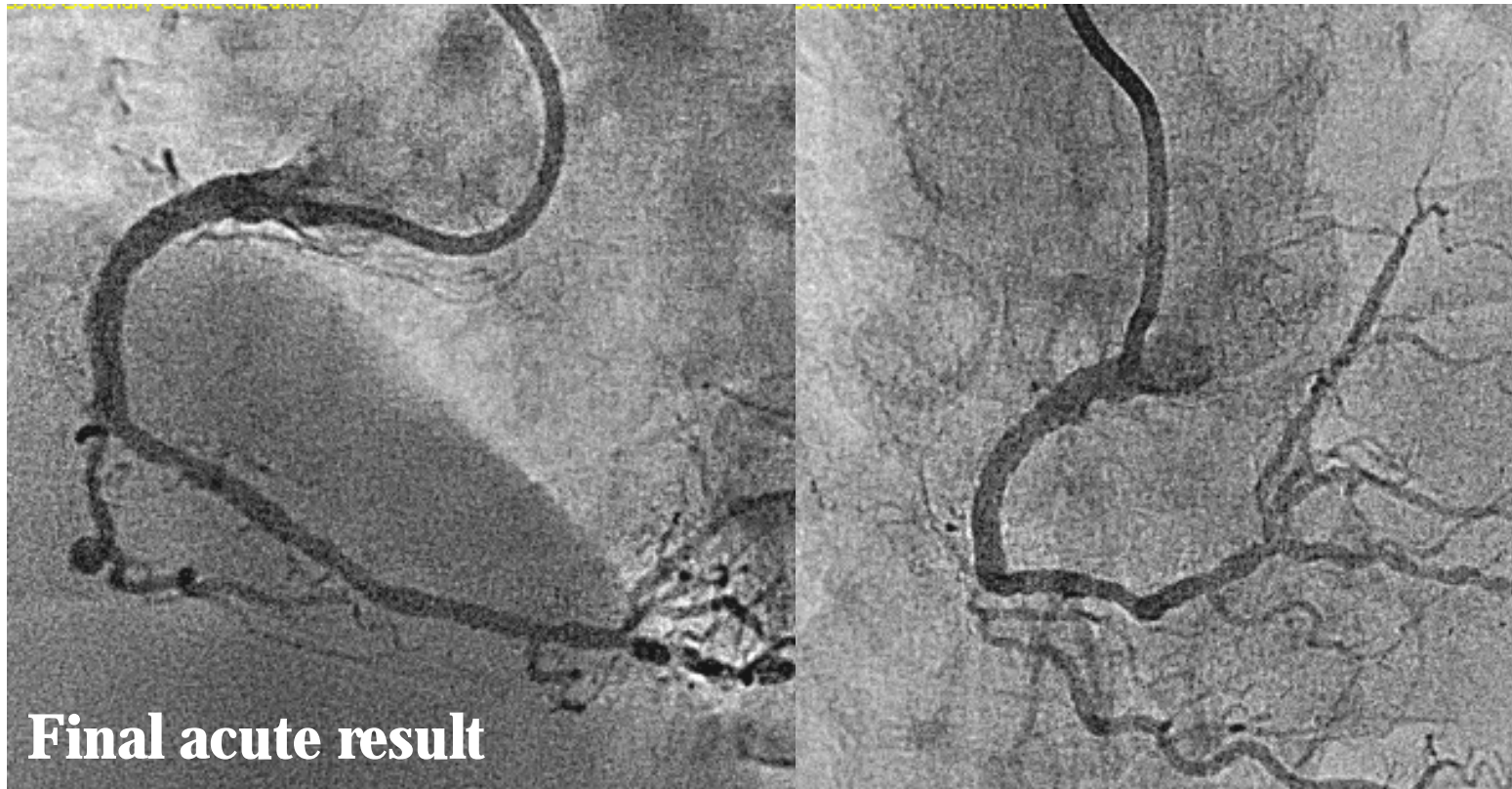
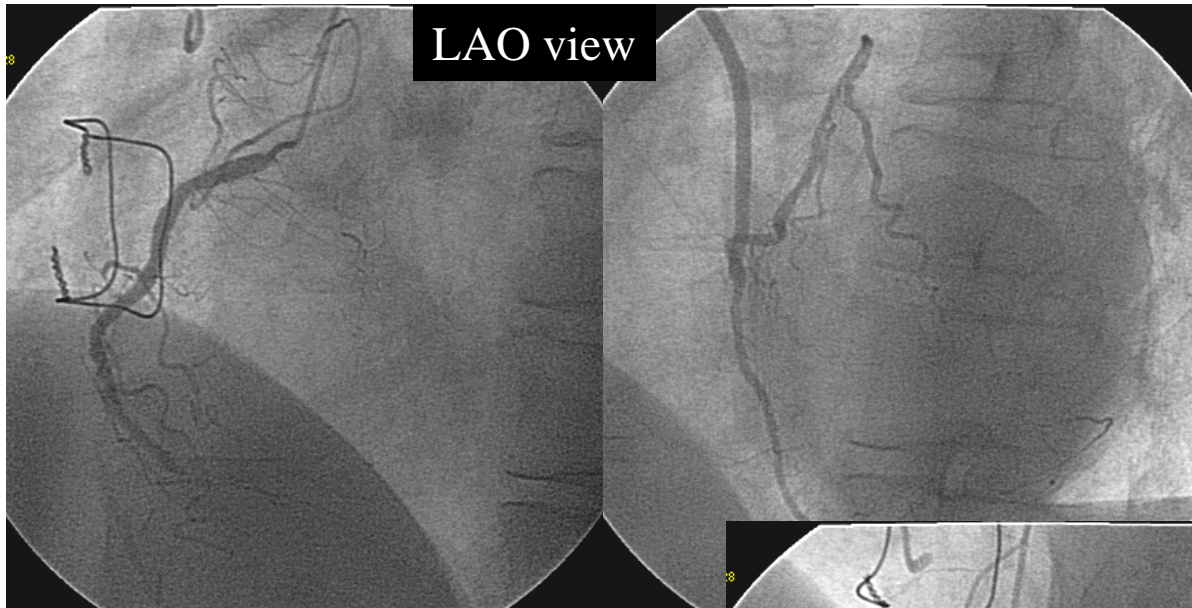




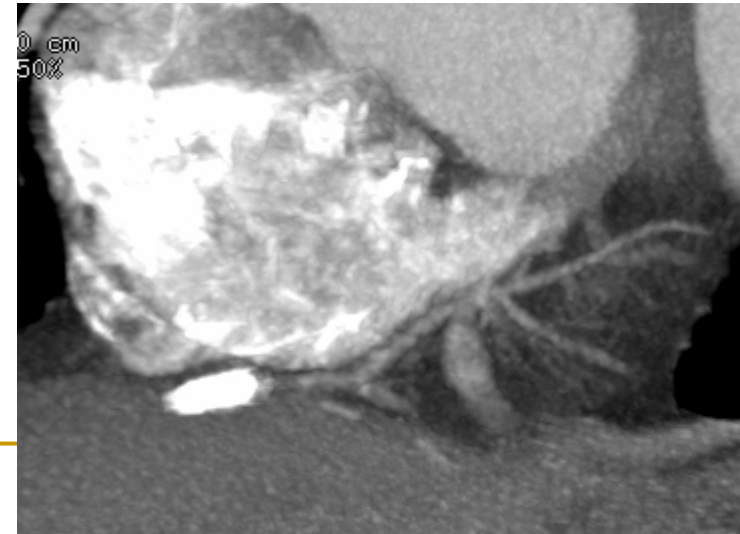
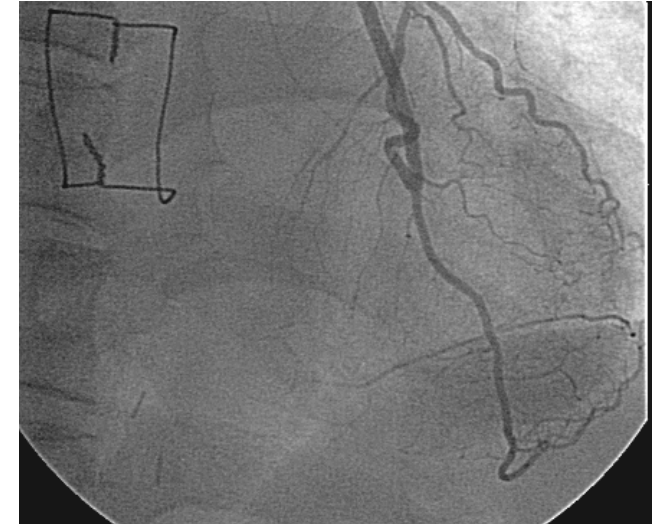
Image for CTO-PCI: MSCT

- Case 5:
 - Distal RCA, stent reoccluded CTO
 - MSCT showed collateral quite better than angiogram.

Case 3: MSCT supported PCI collateral assessment



Case 3: MSCT supported PCI collateral assessment



Case 3: MSCT supported PCI collateral assessment

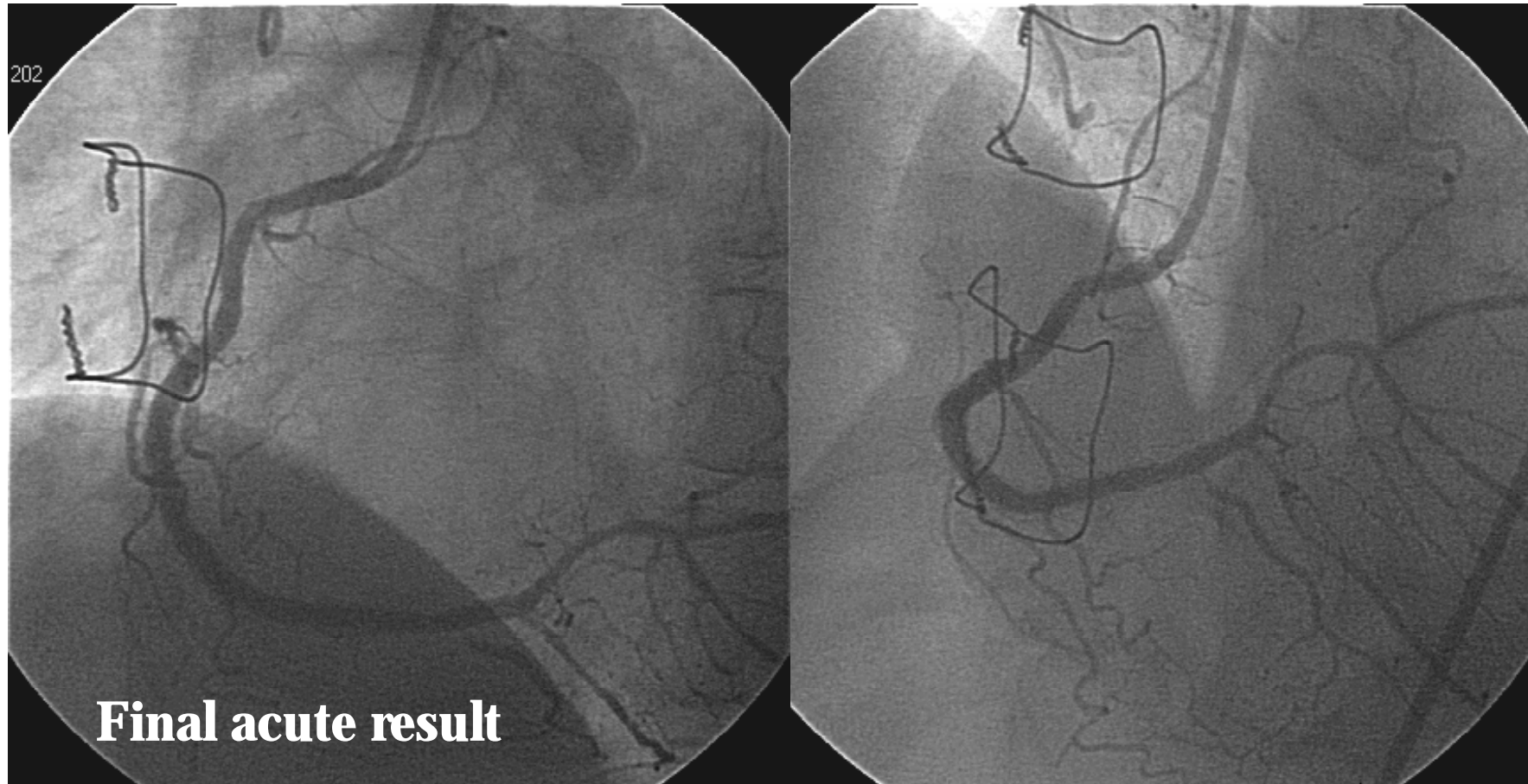
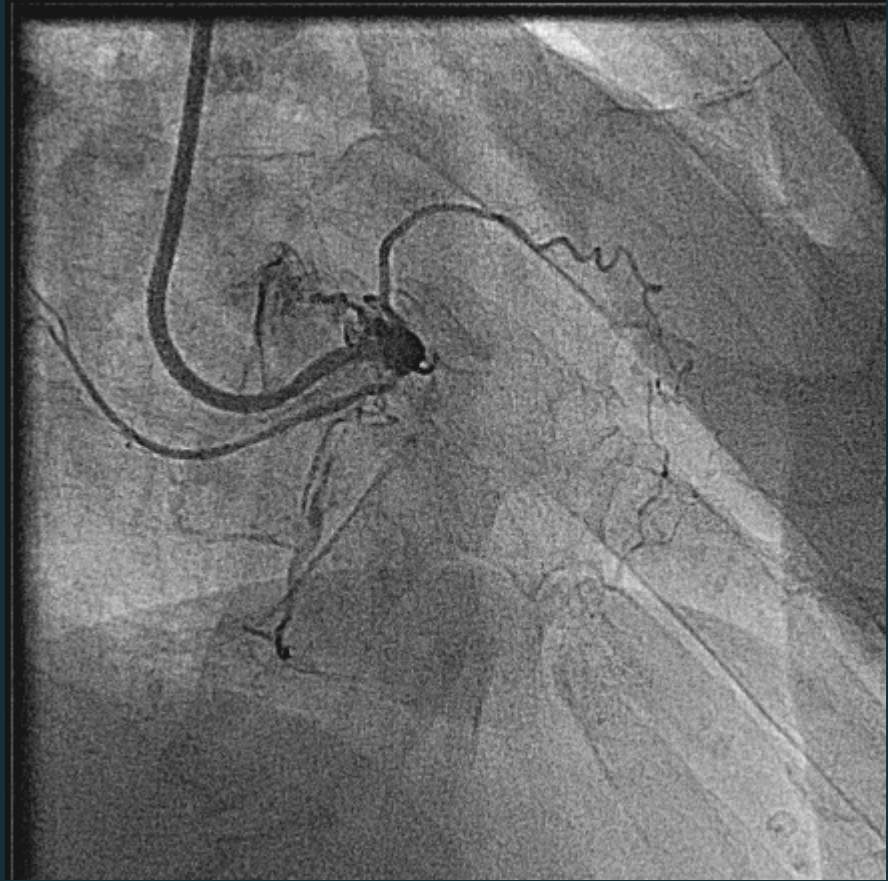
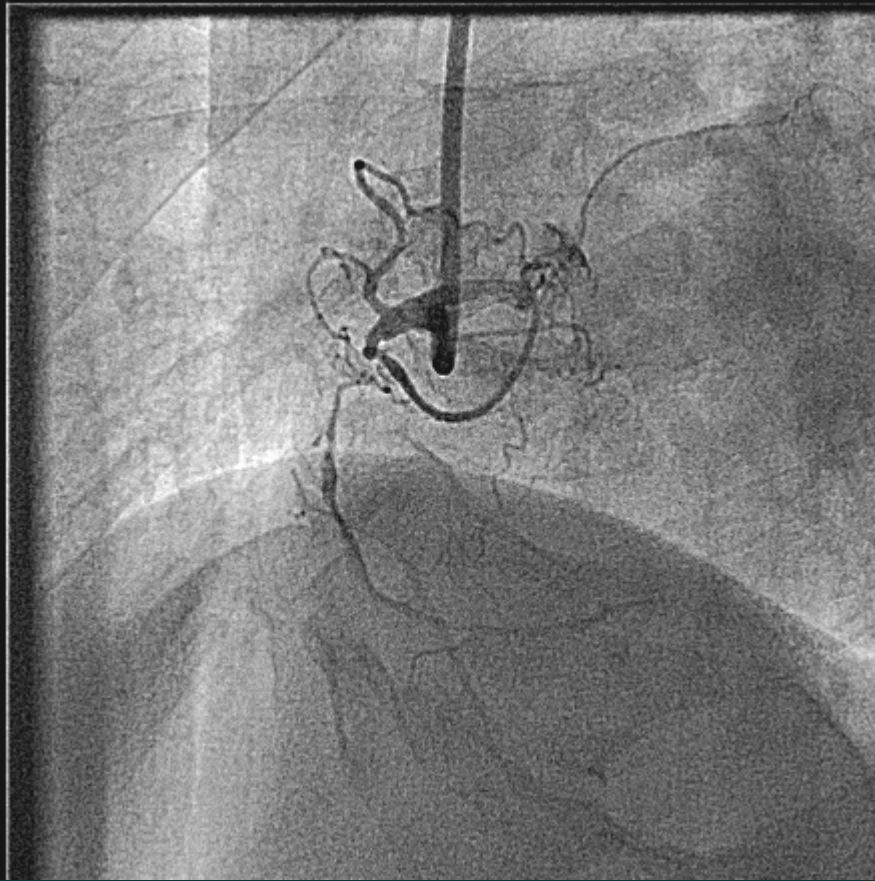




Image for CTO-PCI MSCT and IVUS

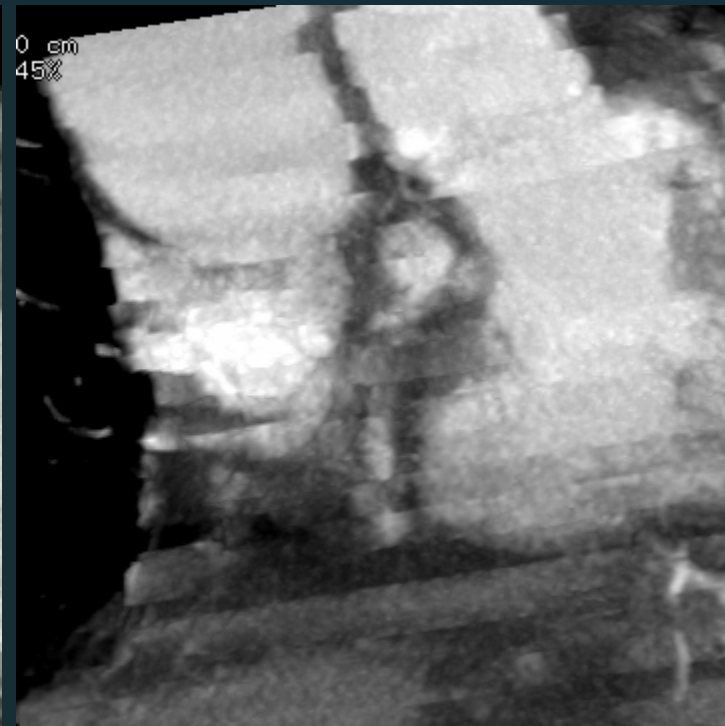
- Case 7:
- CAG showed CTO in proximal RCA.
- CT showed straight without calcium CTO.
- IVUS confirmed CTO entrance and wire position.

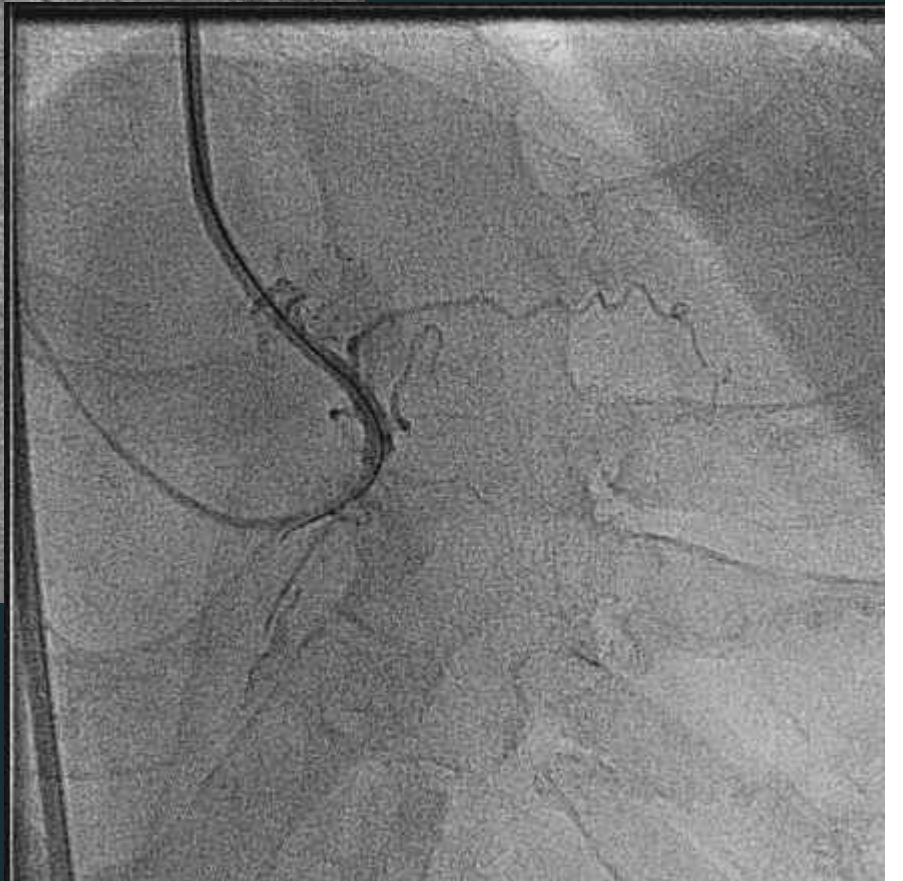
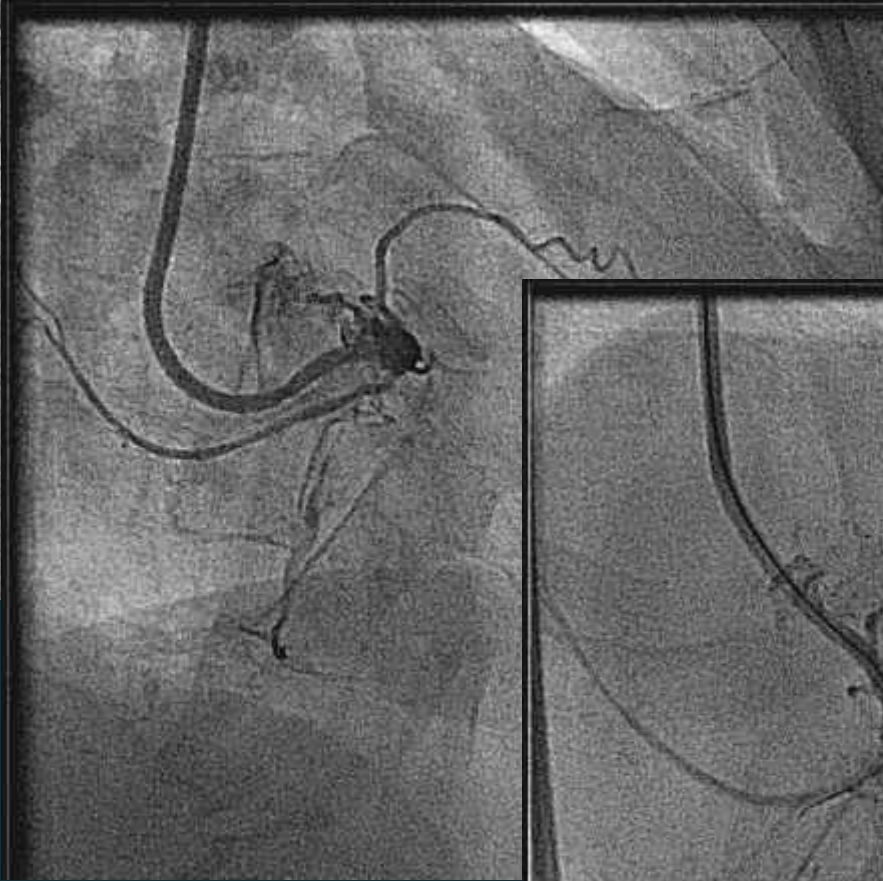
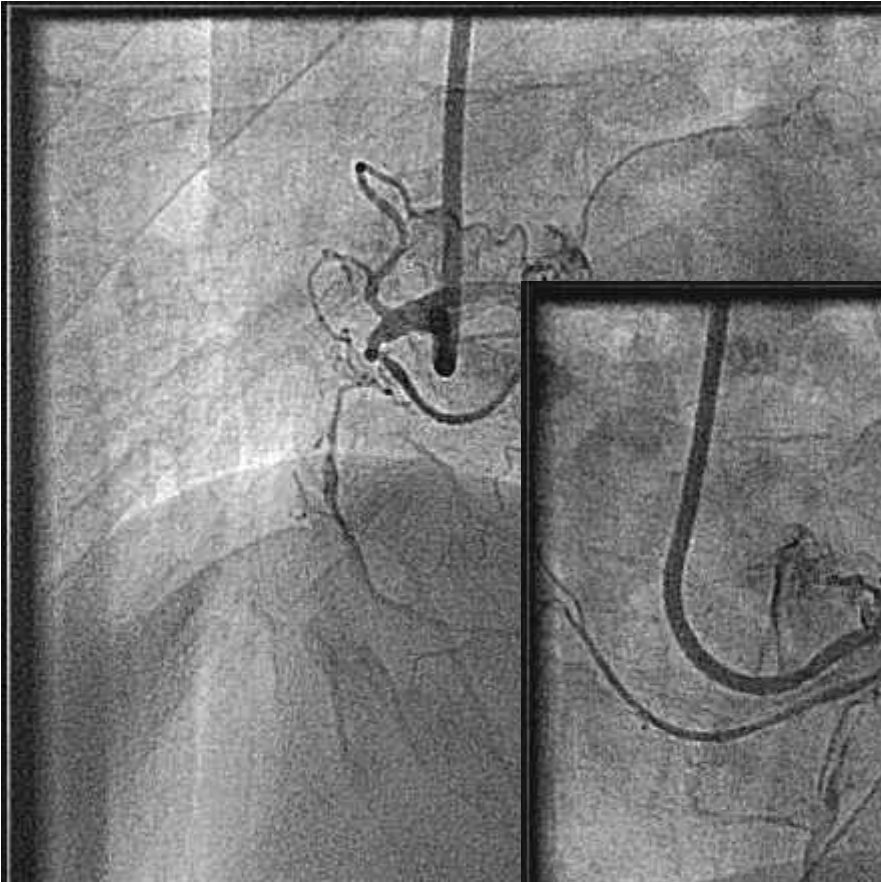
Case; predicted easier CTO in RCA

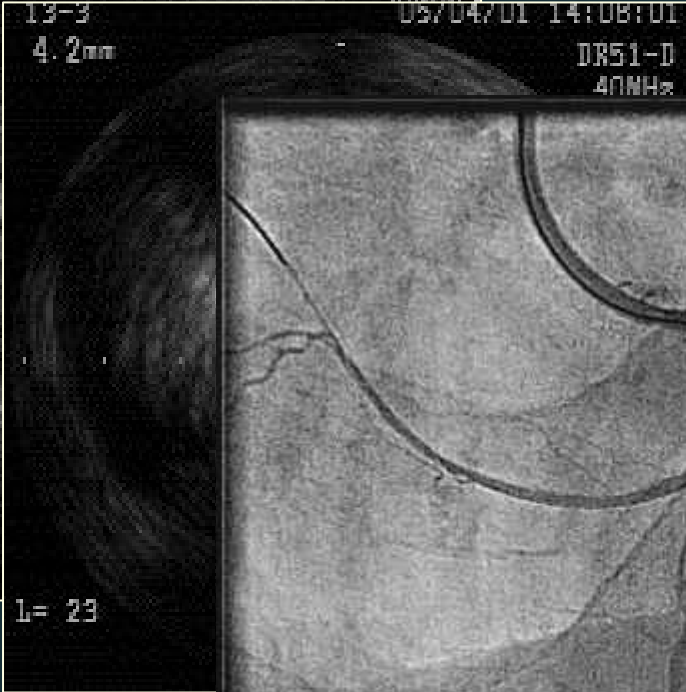
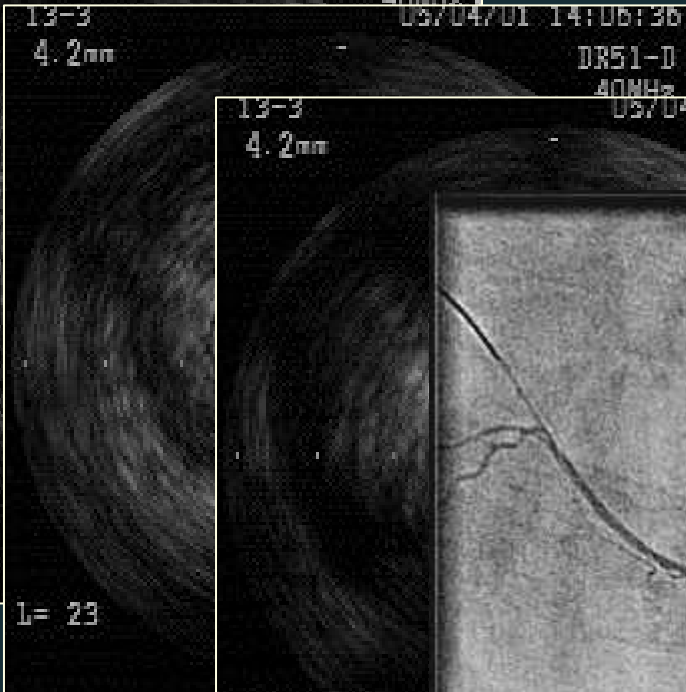


RGMC: 0504003

Case; occluded segment assessment







Case; predicted easier CTO in RCA

144ml 21.2min

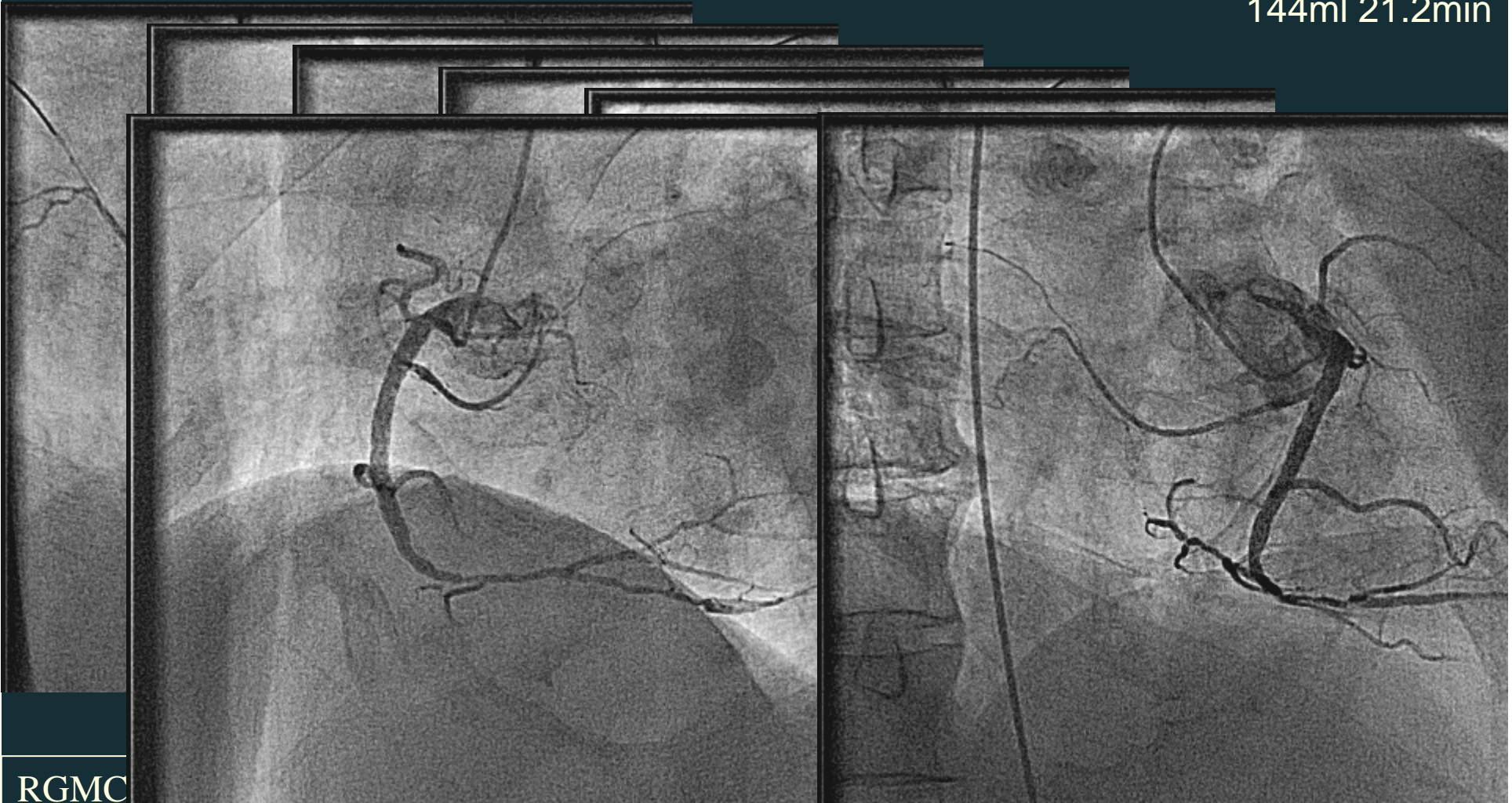


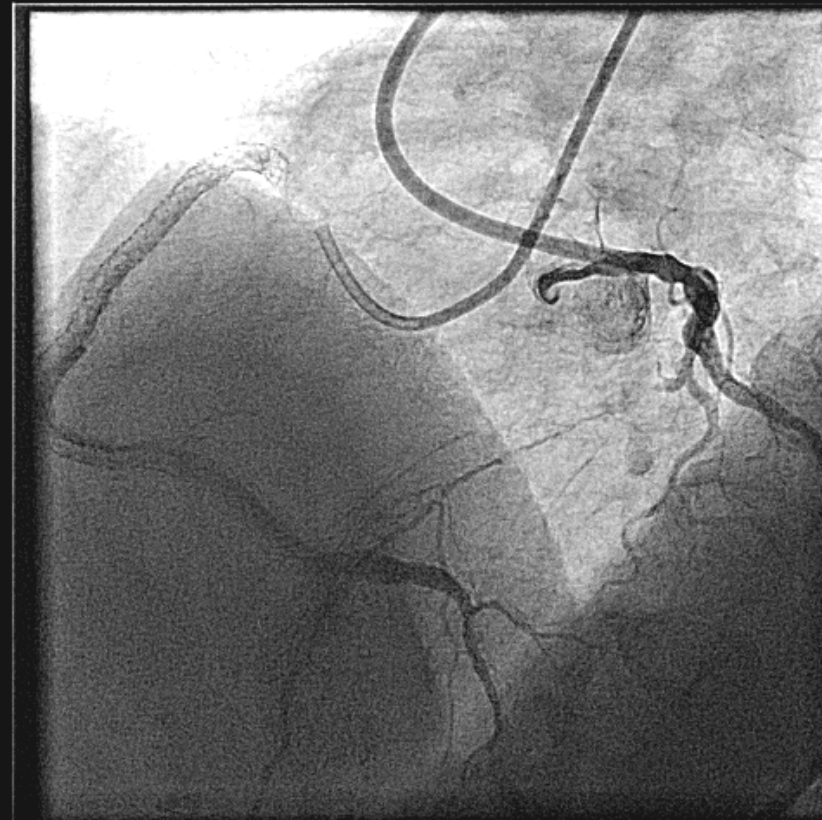


Image for CTO-PCI MSCT and IVUS

- Case 8:
- Large OMI inferior case
- Revascularization of LAD is very important.
- MSCT showed calcium mass in mid LAD which disturb wire cross to distal LAD.
 - Grading CTO-PCI.
- IVUS was effective to bail out of wire cross.

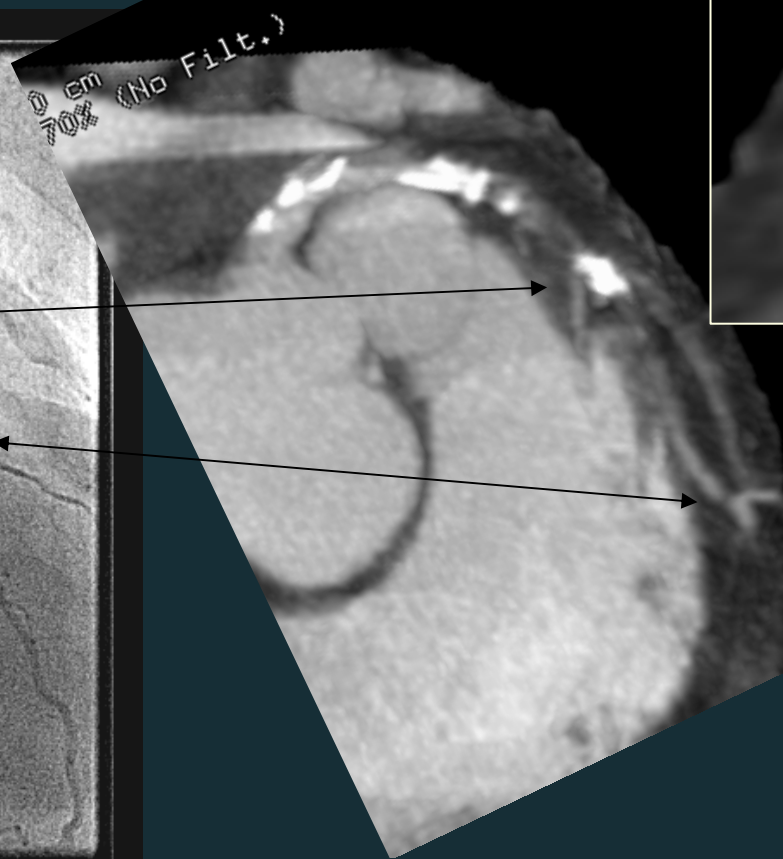
CTO PCI

wire cross false to true



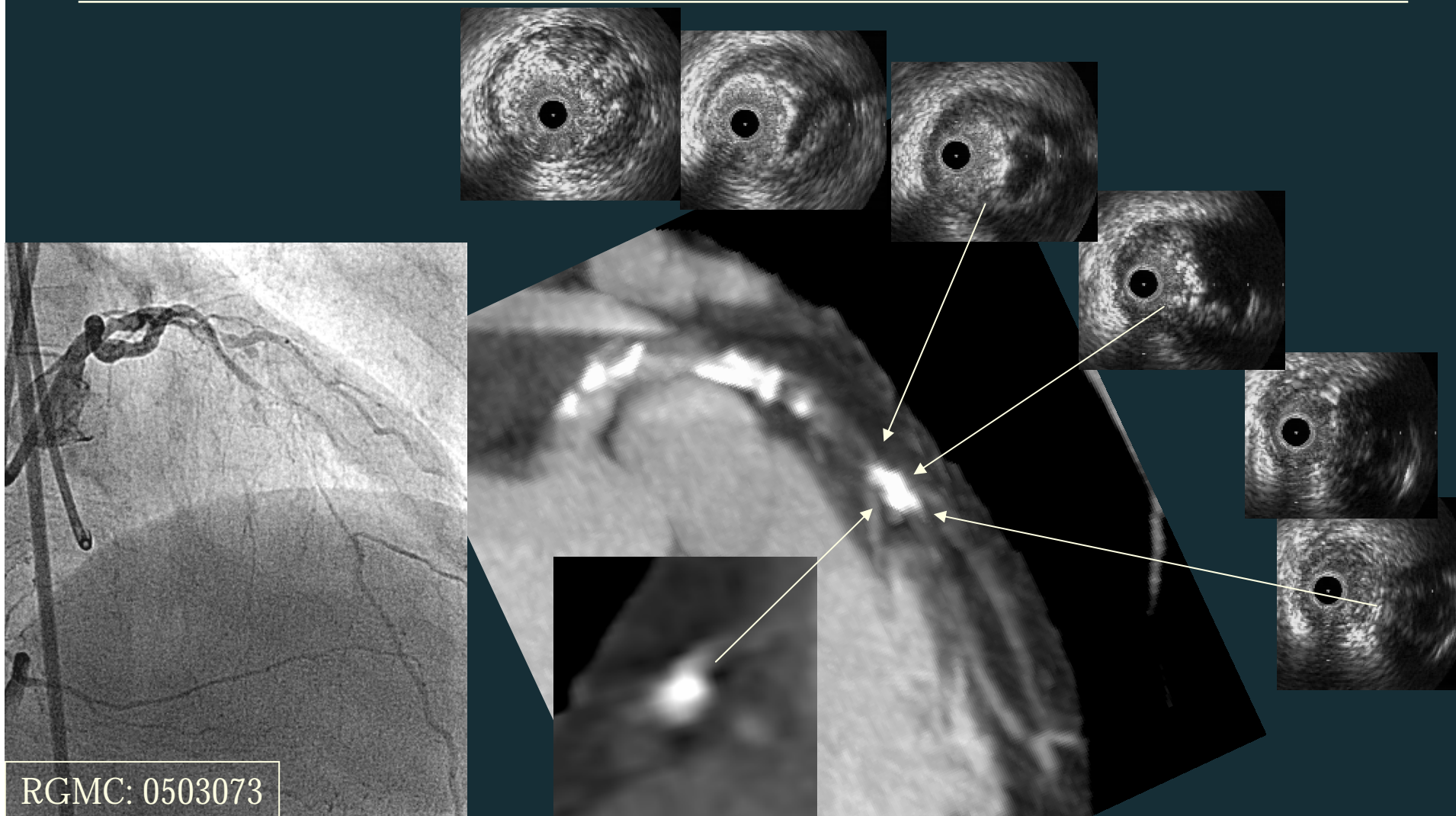
CTO PCI

wire cross false to true



CTO PCI

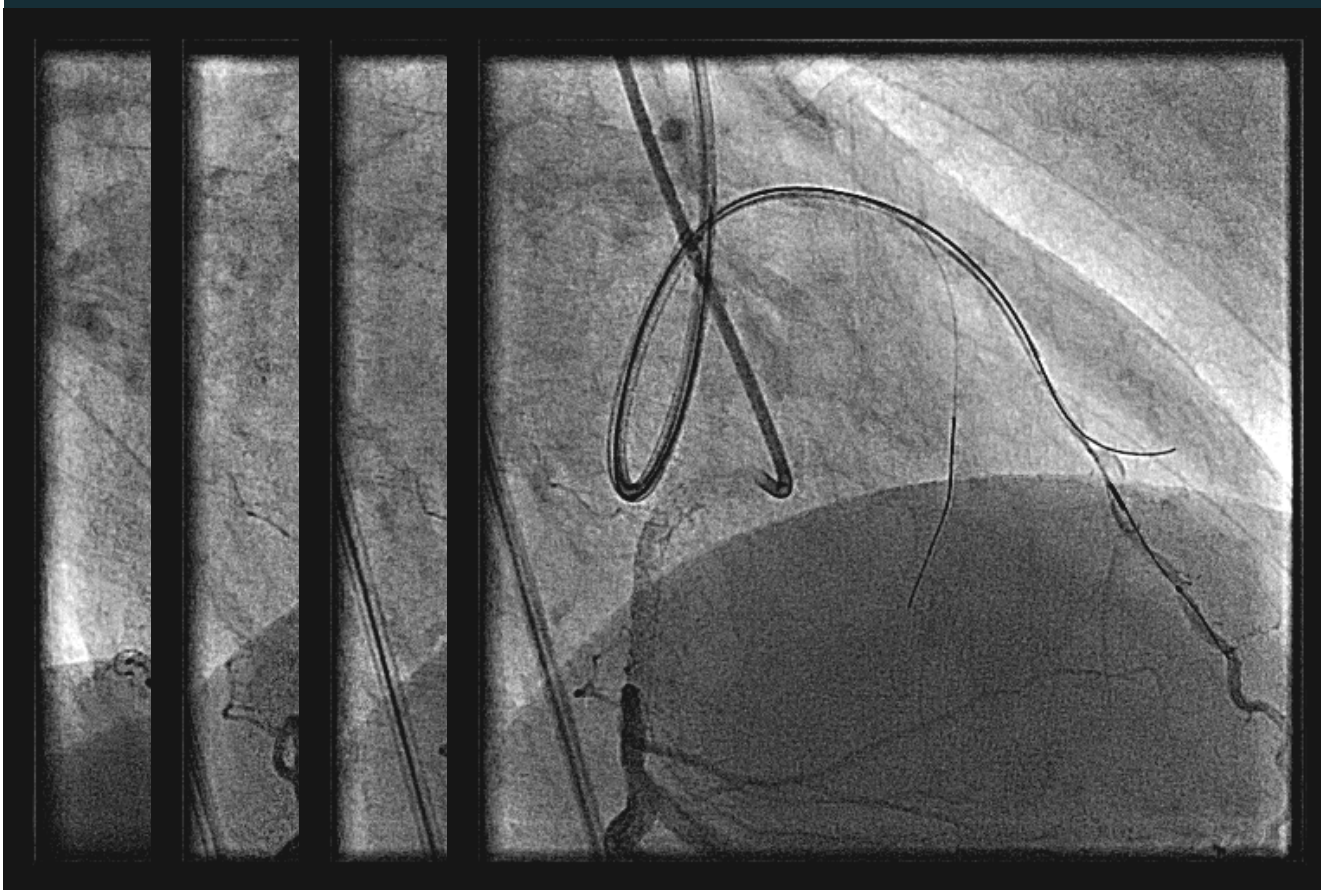
wire cross false to true



RGMC: 0503073

CTO PCI

wire cross false to true



CTO PCI

wire cross false to true

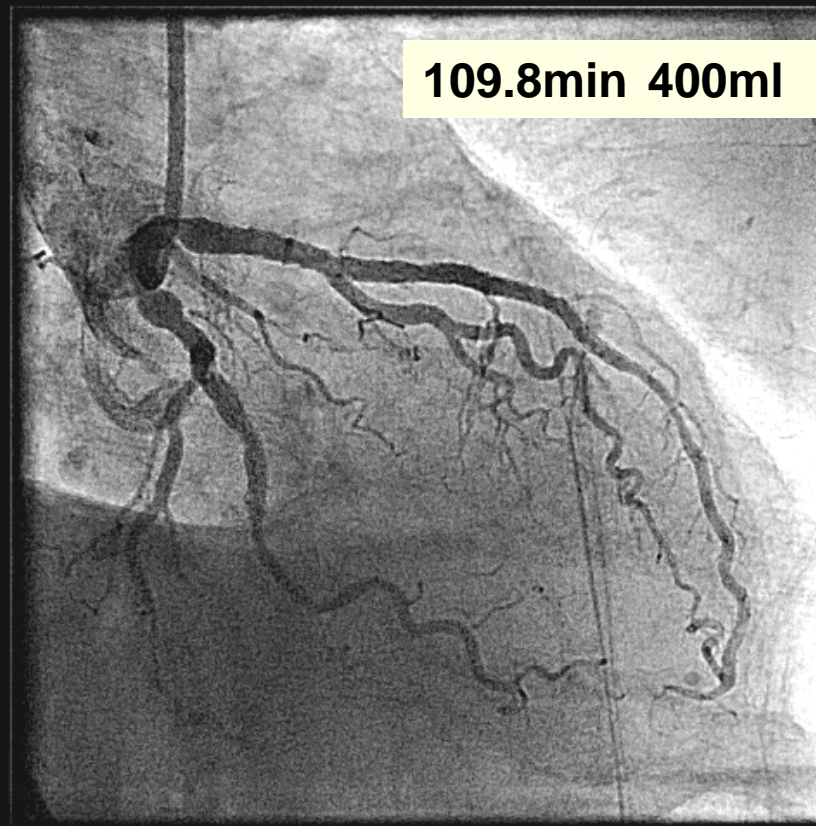
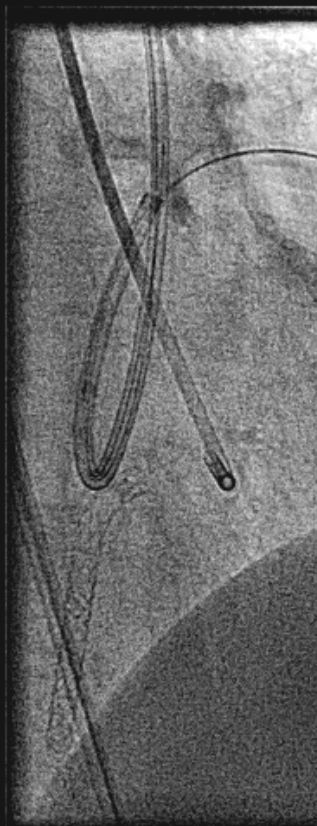




Image guided CTO-PCI

- To succeed the CTO-PCI, there is no definite answer. So we should prepare as complete as possible, to respond to any kind of happening.
- Now, very effective new technique; retrograde wire technique was well developed with refined devices, however image modalities are still helpful too.



Image guided CTO-PCI

- Further, with using the image information, the review of CTO-PCI must be more effective and it improve our CTO-PCI skill better and better.