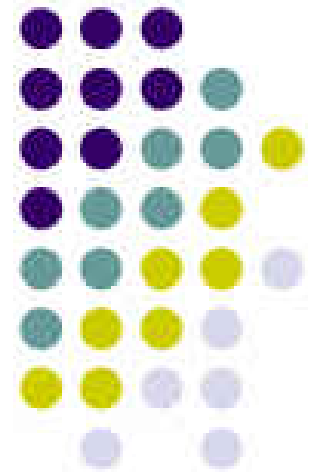


# OCT in Acute Coronary Syndrome! A Hot Potato?



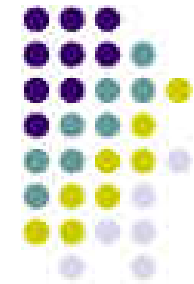
Jin-Man Cho, MD

Kyung Hee University, Korea



# Disclosure

- The contents herein is my own personal opinions and do not necessarily reflect the position or opinion of company



# Considerations

- Cons
  - D2B time
  - Cost
    - Extra 3 million KRW
  - Risk
  - Influence on clinical decision making
- Pros
  - visualization of vulnerable plaque
  - evaluate the characteristics of culprit lesions

# Assessment of Culprit Lesion Morphology in Acute Myocardial Infarction

## Ability of Optical Coherence Tomography Compared With Intravascular Ultrasound and Coronary Angioscopy

Takashi Kubo, MD, PHD, Toshio Imanishi, MD, PHD, Shigeho Takarada, MD, PHD, Akio Kuroi, MD, Satoshi Ueno, MD, Takashi Yamano, MD, Takashi Tanimoto, MD, Yoshiki Matsuo, MD, PHD, Takashi Masho, MD, Hironori Kitabata, MD, Kazushi Tsuda, MD, PHD, Yoshiaki Tomobuchi, MD, PHD, Takashi Akasaka, MD, PHD

Wakayama, Japan

### Objectives

The aim of the present study was to evaluate the ability of optical coherence tomography (OCT) for assessment of the culprit lesion morphology in acute myocardial infarction (AMI) in comparison with intravascular ultrasound (IVUS) and coronary angioscopy (CAS).

### Background

Optical coherence tomography is a new intravascular imaging method with a high resolution of approximately 10  $\mu\text{m}$ . This may allow us to assess the vulnerable plaques in detail in vivo.

### Methods

We enrolled 30 patients with AMI and analyzed the culprit lesion by OCT, CAS, and IVUS.

### Results

The average duration from the onset of symptom to OCT imaging was  $3.8 \pm 1.0$  h. The incidence of plaque rupture observed by OCT was 73%, and it was significantly higher than that by CAS (47%,  $p = 0.035$ ) and IVUS (40%,  $p = 0.009$ ). Furthermore, OCT (23%) was superior to CAS (3%,  $p = 0.022$ ) and IVUS (0%,  $p = 0.005$ ) in the detection of fibrous cap erosion. The intracoronary thrombus was observed in all cases by OCT and CAS, but it was identified in 33% by IVUS (vs. OCT,  $p < 0.001$ ). Only OCT could estimate the fibrous cap thickness, and it was  $49 \pm 21$   $\mu\text{m}$ . The incidence of thin cap fibroatheroma (TCFA) was 83% in this population by OCT.

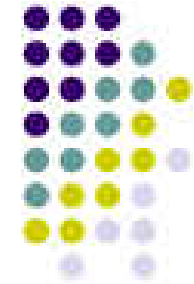
### Conclusions

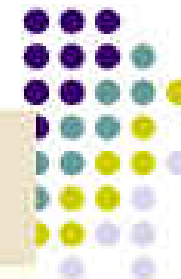
Optical coherence tomography is a feasible imaging modality in patients with AMI and allows us to identify not only plaque rupture, but also fibrous cap erosion, intracoronary thrombus, and TCFA in vivo more frequently compared with conventional imaging techniques. (J Am Coll Cardiol 2007;50:933-9) © 2007 by the American College of Cardiology Foundation



**Table 1** Baseline Characteristics of 30 Patients With AMI

Number of patients	30
Age, yrs	69 ± 11
Male gender	19 (63)
Diabetes mellitus	9 (30)
Hypertension	25 (83)
Cigarette smoking	14 (47)
Hypercholesterolemia (total cholesterol >220 mg/dl)	16 (53)
Culprit vessel	
LAD	11 (37)
LCx	5 (16)
RCA	14 (47)
Percent diameter stenosis, %	88 ± 26
TIMI flow grade	
0	19 (63)
1	2 (7)
2	3 (10)
3	6 (20)
Duration from the onset of symptom to OCT imaging, h	3.8 ± 1.0





**Table 2** OCT, CAS, and IVUS Findings for Corresponding Images

Finding	OCT (n = 30)	CAS (n = 30)	IVUS (n = 30)	p Value
Fibrous cap disruption	22 (73)*†	14 (47)	12 (40)	0.021
Fibrous cap erosion	7 (23)*†	1 (3)	0 (0)	0.003
Thrombus	30 (100)†	30 (100)‡	10 (33)	<0.001

**Table 3** OCT Findings of the Culprit Lesion in 30 Patients With AMI

Fibrous cap thickness, $\mu\text{m}^*$	49 $\pm$ 21
Lipid-rich plaque (lipid $\geq$ 2 quadrants)	28 (93)
TCFA	25 (83)

# Safety and Feasibility of an Intravascular Optical Coherence Tomography Image Wire System in the Clinical Setting

Tetsu Yamaguchi, MD<sup>a,\*</sup>, Mitsuyasu Terashima, MD<sup>b</sup>, Takashi Akasaka, MD<sup>c</sup>,  
Takahiro Hayashi, MD<sup>d</sup>, Kyoichi Mizuno, MD<sup>e</sup>, Toshiya Muramatsu, MD<sup>f</sup>, Masato Nakamura, MD<sup>g</sup>,  
Shigeru Nakamura, MD<sup>h</sup>, Satoshi Saito, MD<sup>i</sup>, Masamichi Takano, MD<sup>e</sup>, Tadateru Takayama, MD<sup>j</sup>,  
Junichi Yoshikawa, MD<sup>k</sup>, and Takahiko Suzuki, MD<sup>b</sup>

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Optical coherence tomography (OCT) is a fiber-optic technology that enables high-resolution intracoronary imaging. The aim of this study was to evaluate the safety and feasibility of intracoronary imaging with OCT in the clinical setting; 76 patients with coronary artery disease from 8 centers were enrolled. The OCT imaging system (ImageWire, Light Imaging Inc., Westford, Massachusetts) consists of a 0.006 inch fiber-optic core that rotates within a 0.016 inch transparent sheath. OCT imaging was performed during occlusion of the artery with a compliant balloon and continuous flushing. Intravascular ultrasound (IVUS) imaging was performed in the same segments. We assessed the safety and feasibility of the OCT imaging, compared with IVUS. Vessel occlusion time was  $48.3 \pm 13.5$  seconds and occlusion-balloon pressure was  $0.4 \pm 0.1$  atmospheres. Flushing with lactated Ringer's solution was performed at a rate of  $0.6 \pm 0.4$  ml/s. No significant adverse events, including vessel dissection or fatal arrhythmia, were observed. Procedural success rates were 97.3% by OCT and 94.5% by IVUS. The OCT image wire was able to cross 5 of 6 tight lesions that the IVUS catheter was unable to cross. Of the 98 lesions in which both OCT and IVUS were successfully performed, OCT imaging had an advantage over IVUS for visualization of the lumen border. Minimum lumen diameter and area measurements were significantly correlated between OCT and IVUS imaging ( $r = 0.91$ ,  $p < 0.0001$  and  $r = 0.95$ ,  $p < 0.0001$ , respectively). In conclusion, this multicenter study demonstrates the safety and feasibility of OCT imaging in the clinical setting. © 2008 Elsevier Inc. All rights reserved. (Am J Cardiol 2008;101:562–567)

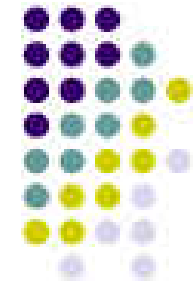


Table 2

Procedural success rates of optical coherence tomography (OCT) and intravascular ultrasound (IVUS) imaging

	OCT	IVUS	p Value
Overall (n = 110)	107 (97.3%)	104 (94.5%)	0.307
Diagnostic angiogram (n = 36)	36 (100%)	36 (100%)	1
PCI			
Before PCI (n = 40)	37 (92.5%)	34 (85.0%)	0.284
After PCI (n = 34)	34 (100%)	34 (100%)	1

Table 3

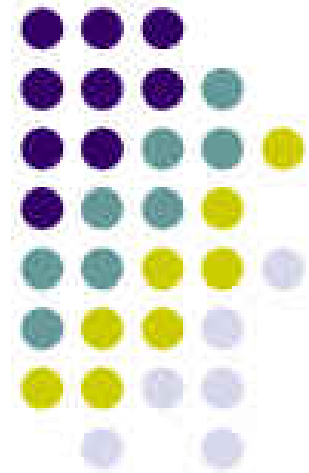
Comparison of lumen border and vessel border visibility between optical coherence tomography (OCT) and intravascular ultrasound (IVUS) imaging

	Lumen Border		Vessel Border	
	OCT (n = 98)	> IVUS (n = 98)	OCT (n = 98)	< IVUS (n = 98)
Good	88	81	5	55
Fair	4	0	7	7
Poor	6	17*	86	36
p Value	0.037		<0.0001	

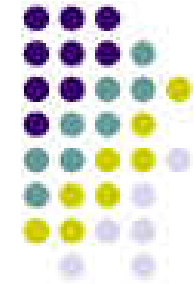


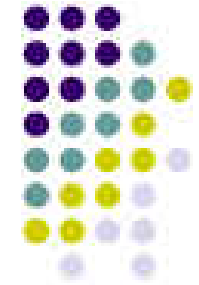
# Limitations of OCT

1. Need to create blood free zone
2. Narrow Scan area: 7 mm
3. Shallow penetration depth: 1.5mm
4. Local Superficial anatomic information
5. No functional information

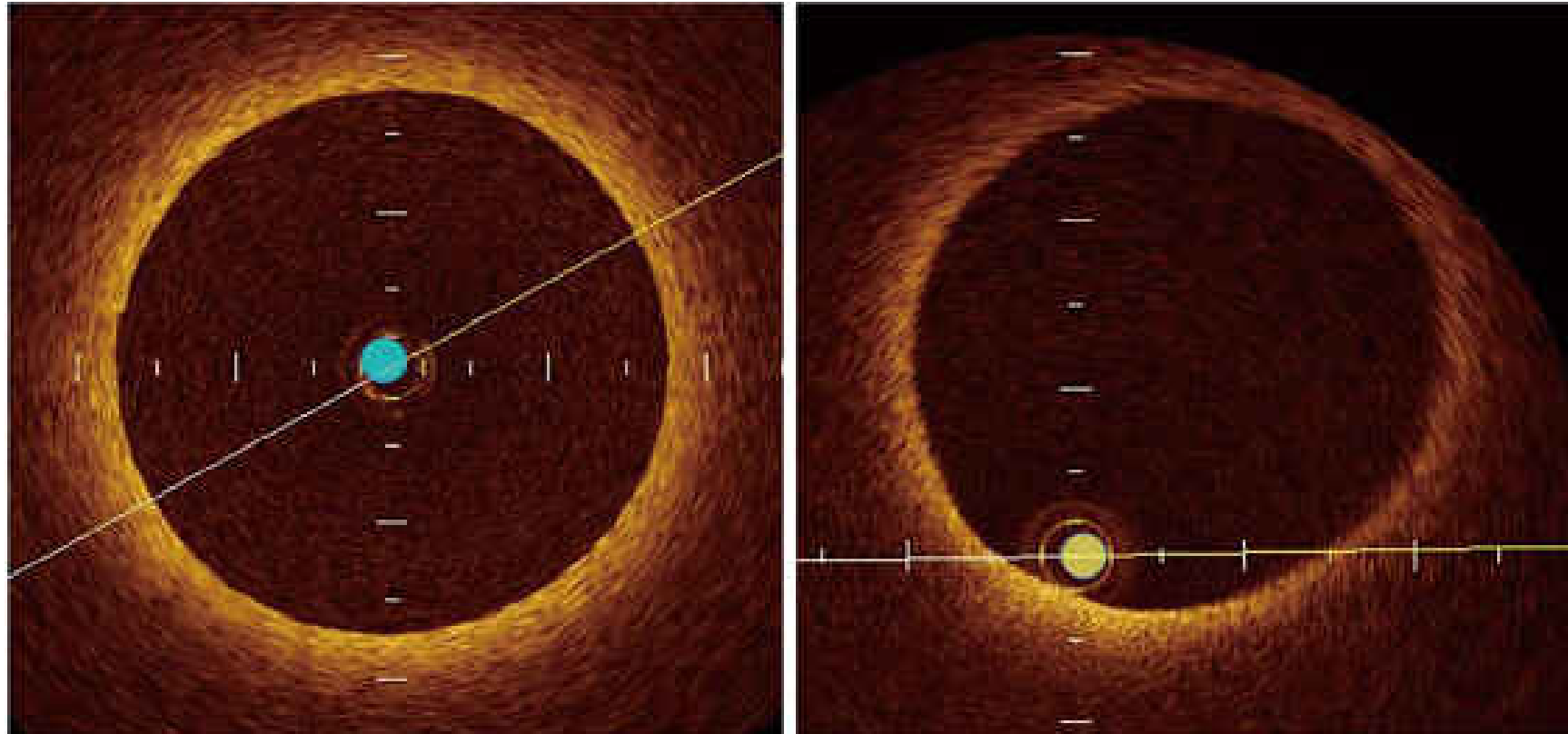


# The Bigger is not always the Better

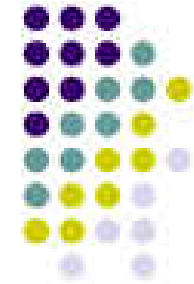




# Location of Image Wire



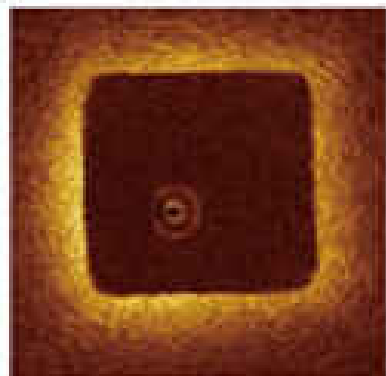
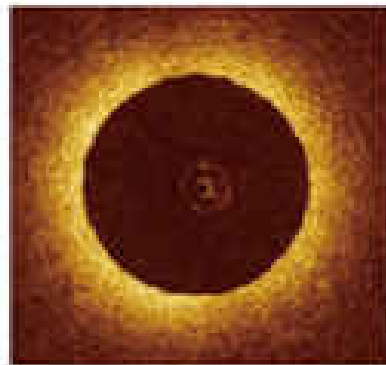
*Dr. Sawada, Kobe University, CircJ 2009*



# Distortion of Image

Image wire (in-center)

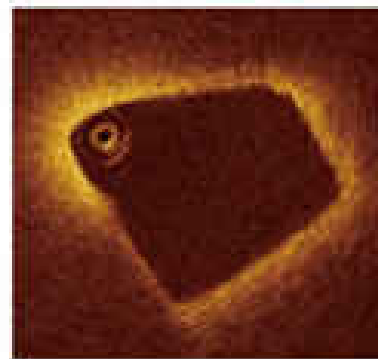
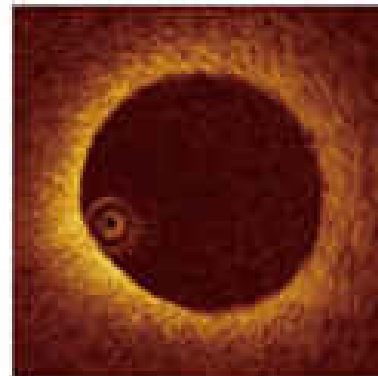
15.6F/s



Distortion (-)

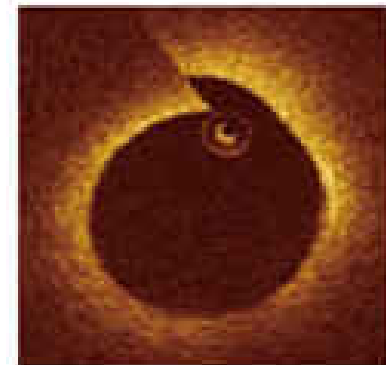
Image wire (off-center)

15.6F/s



Change in brightness

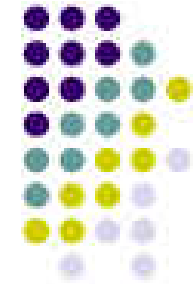
8.2F/s



Motion artifact (+)

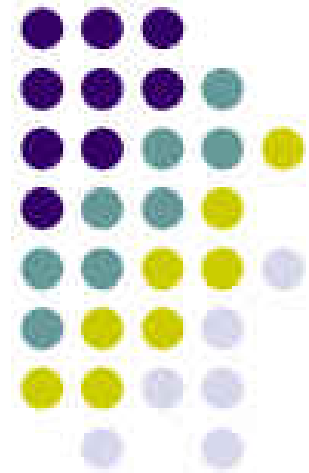
*Dr. Sawada, Kobe University, Circ J 2009*

# Beauty Is Only Skin Deep

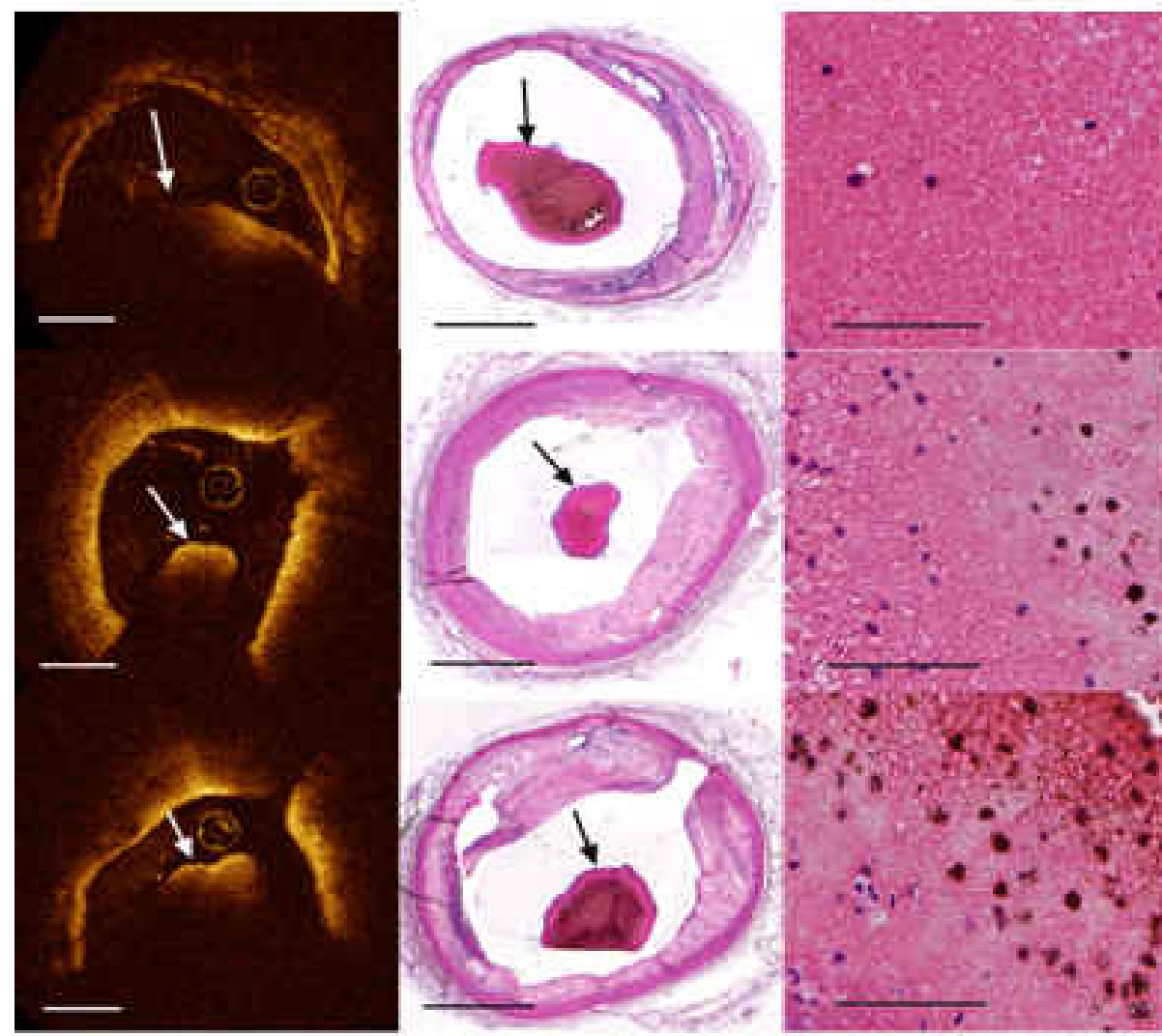
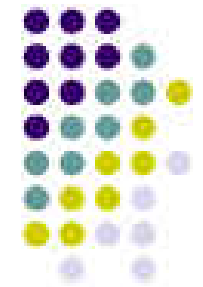


# Clinical Use in ACS

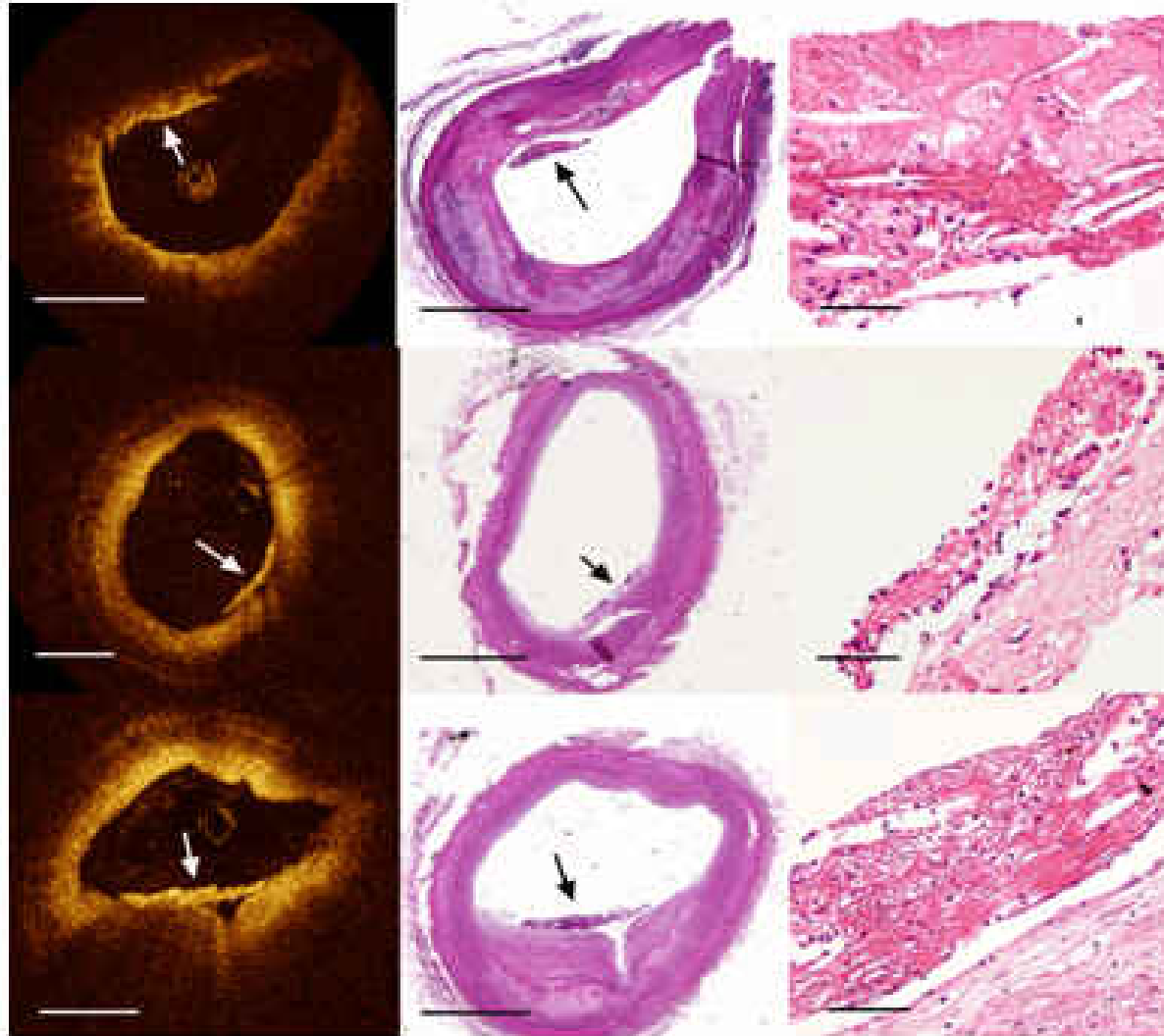
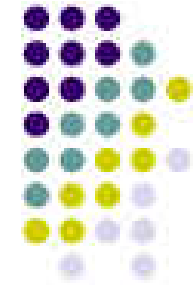
- TCFA
  - Cap thickness
  - Arc of lipid pool
- Ruptured Plaque
- Red thrombus
- White thrombus



# Red Thrombus

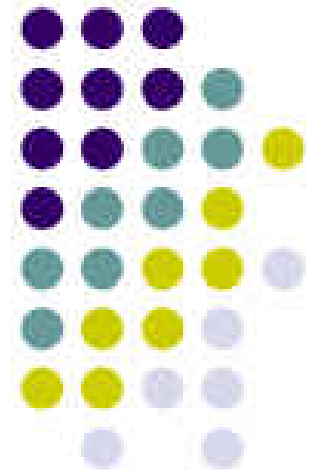


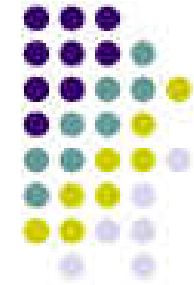
# White Thrombus



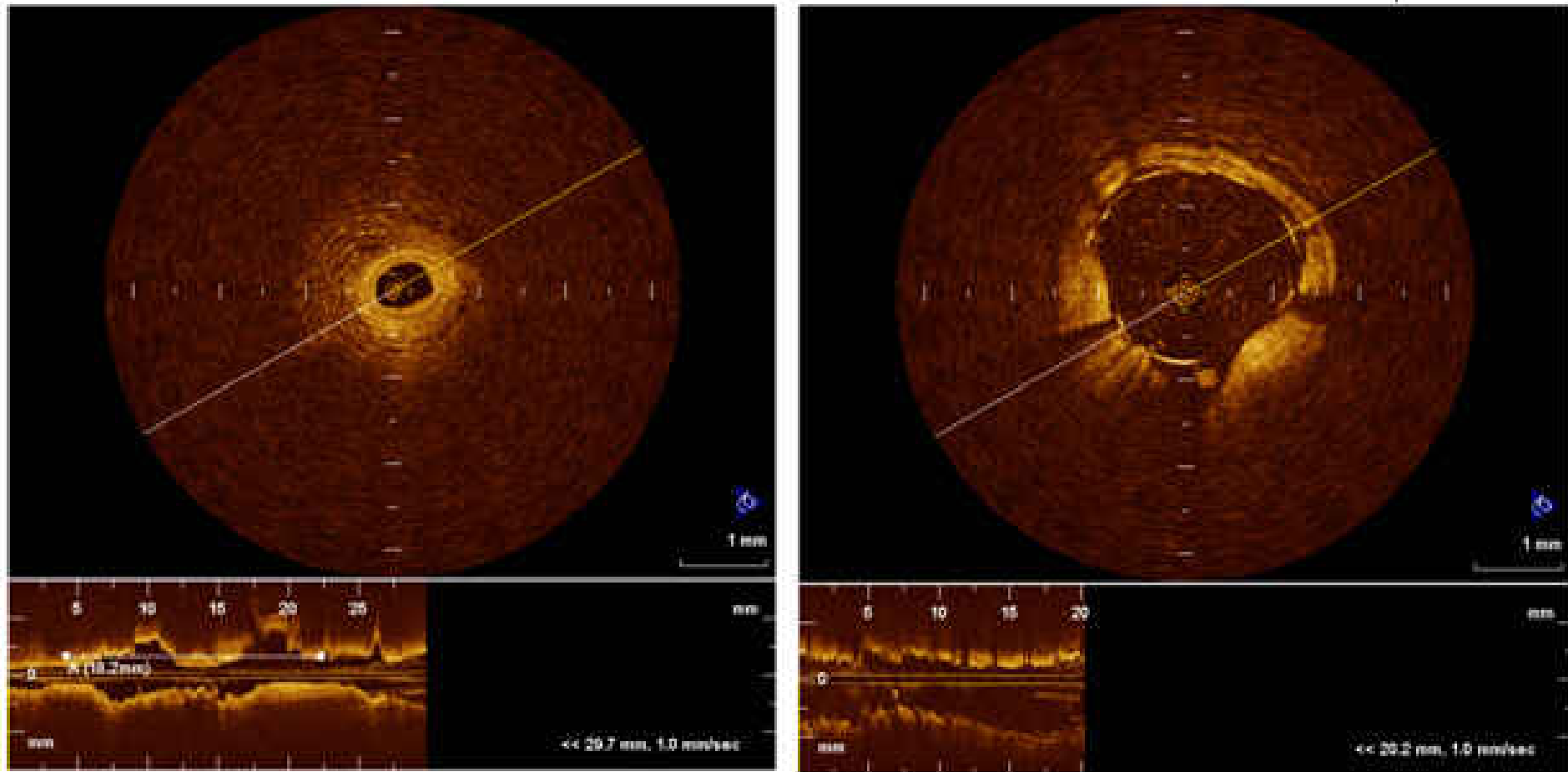


# Experiences at Our Center

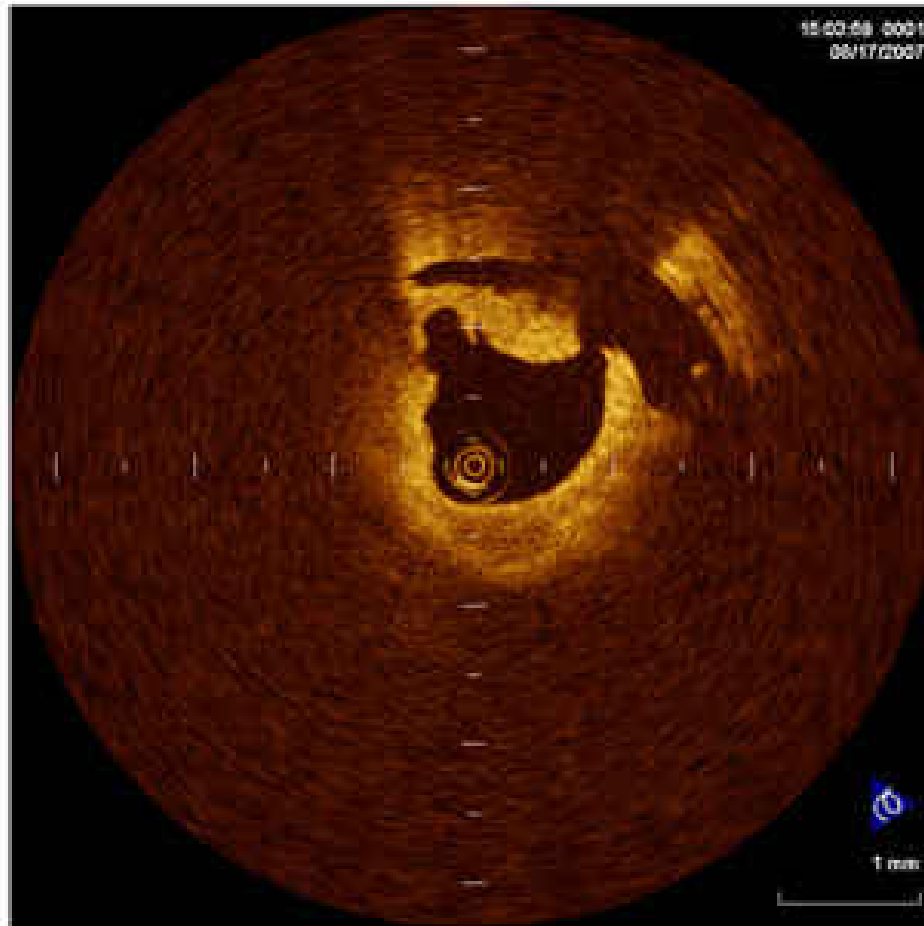
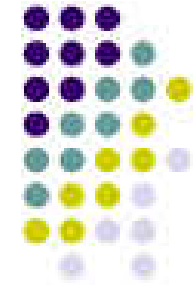




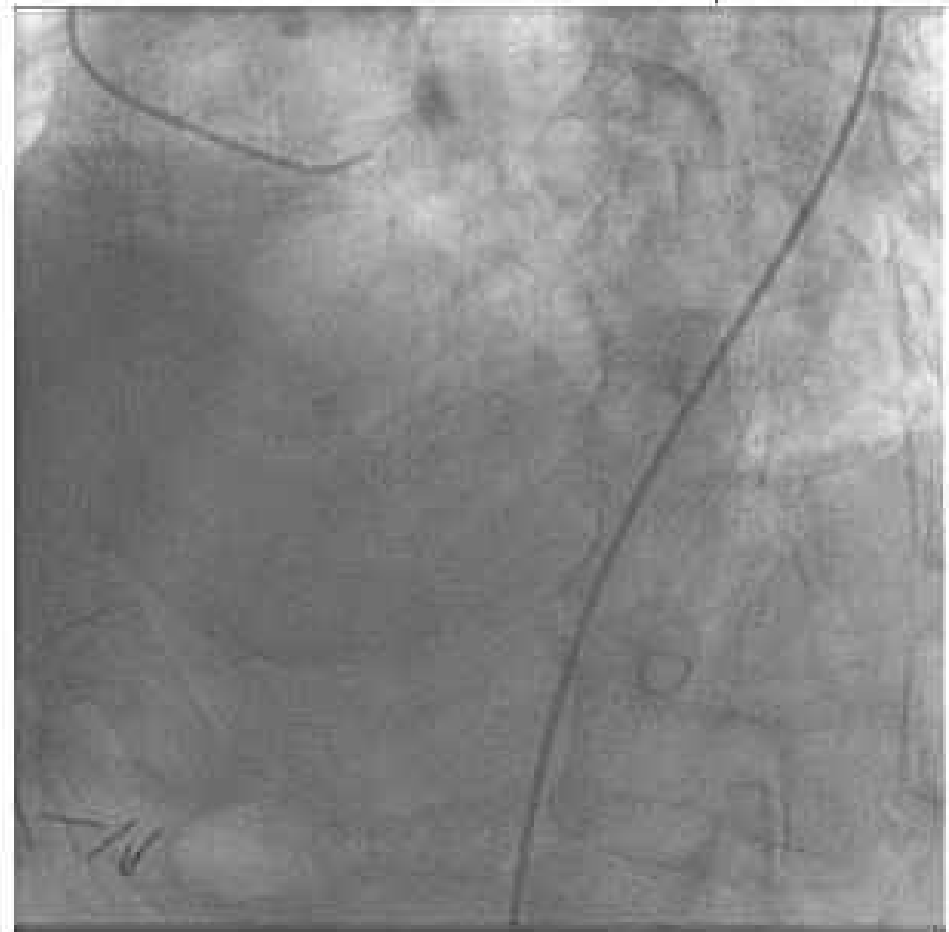
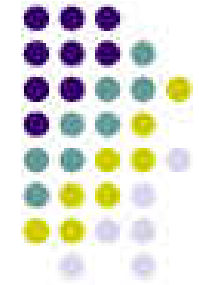
# Case: Acute Coronary Syndrome



# Ruptured Plaque!

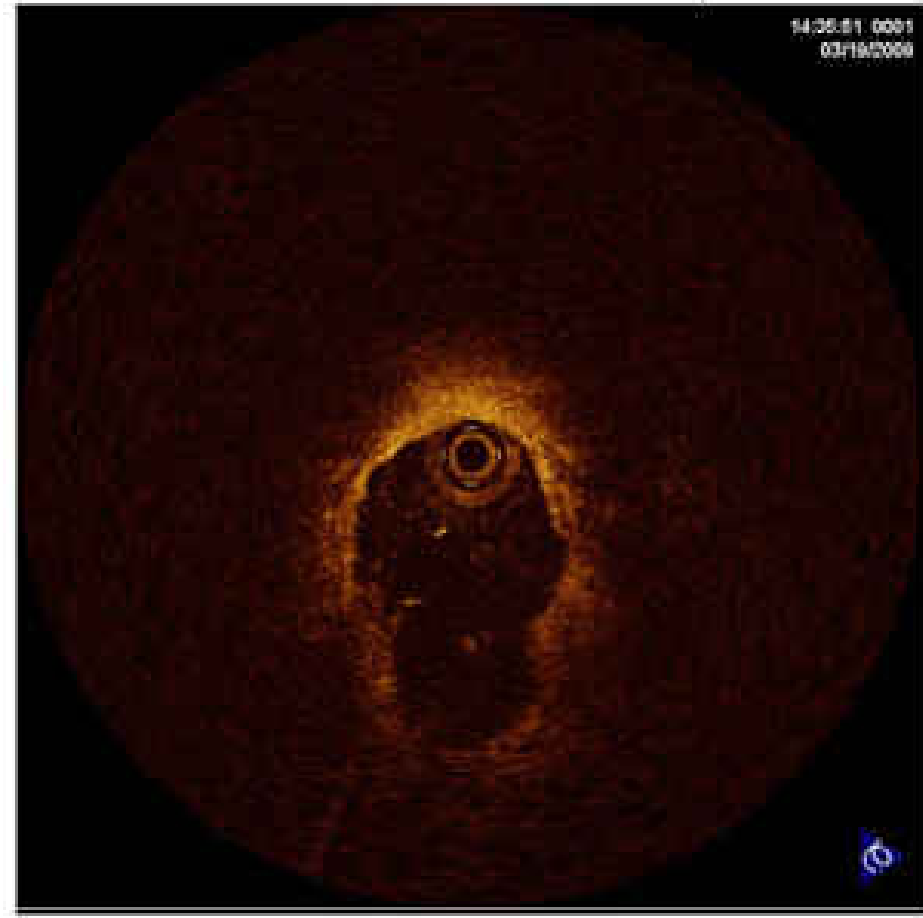
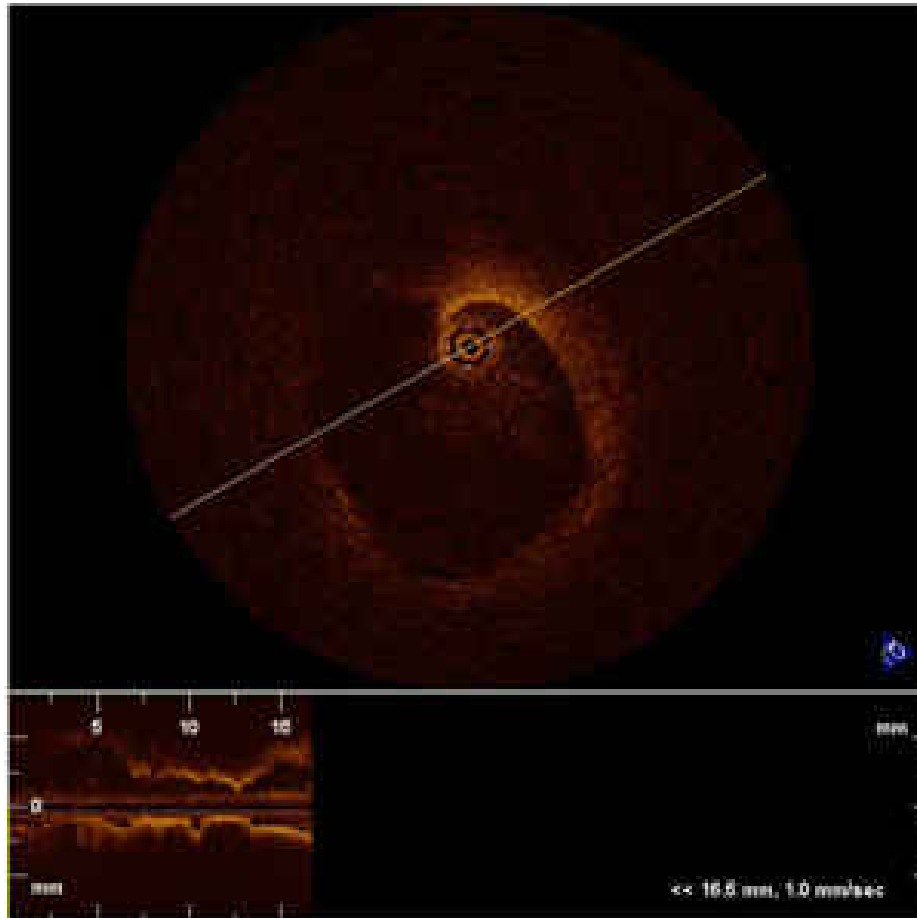
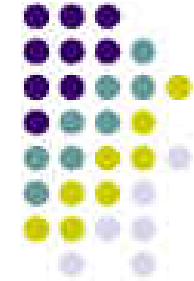


# 75 yo male with dementia visit ER due to dyspnea

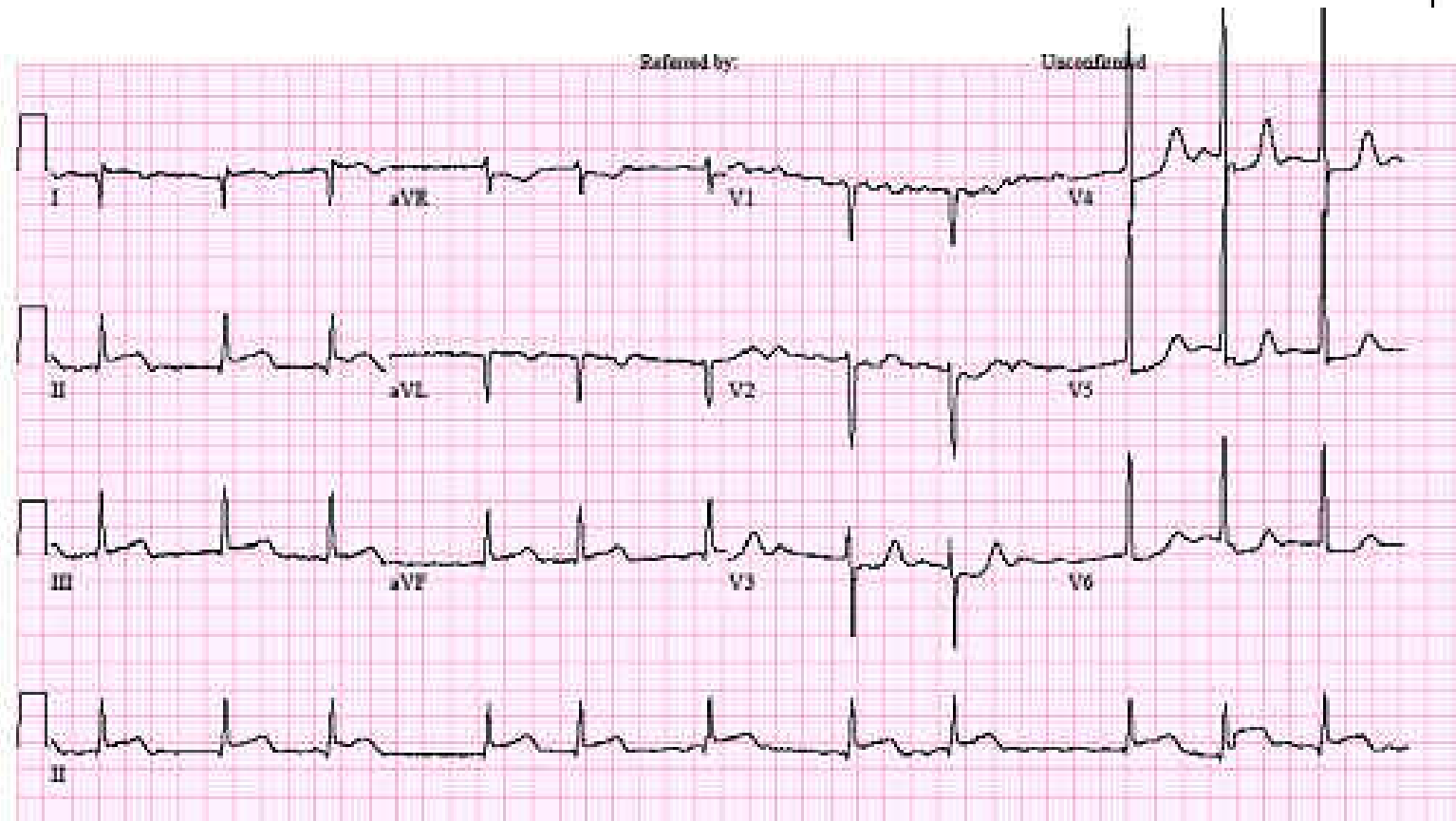
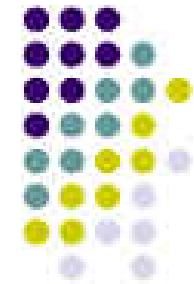




# OCT images



# A case of inferior wall MI with Afib

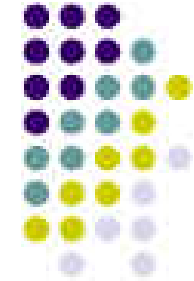


25mm/s 10mm/mV 150Hz 065E 125L 217 CID: 1

EID: Unconfirmed EDT: ORDER

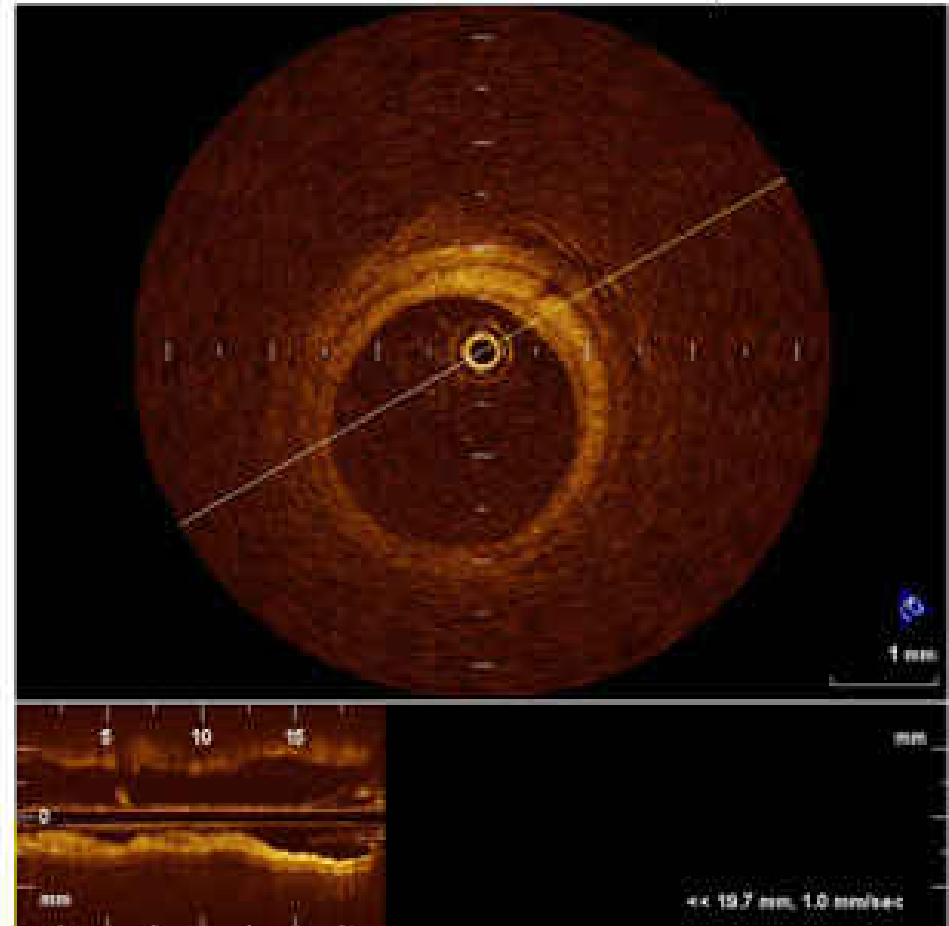
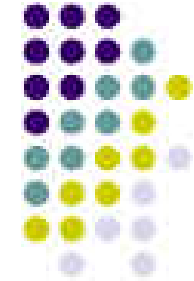
Page 1 of 1

# Primary PCI for STEMI

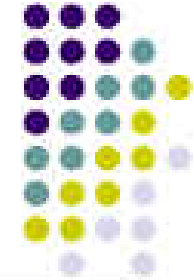




# Outcome and OCT finding

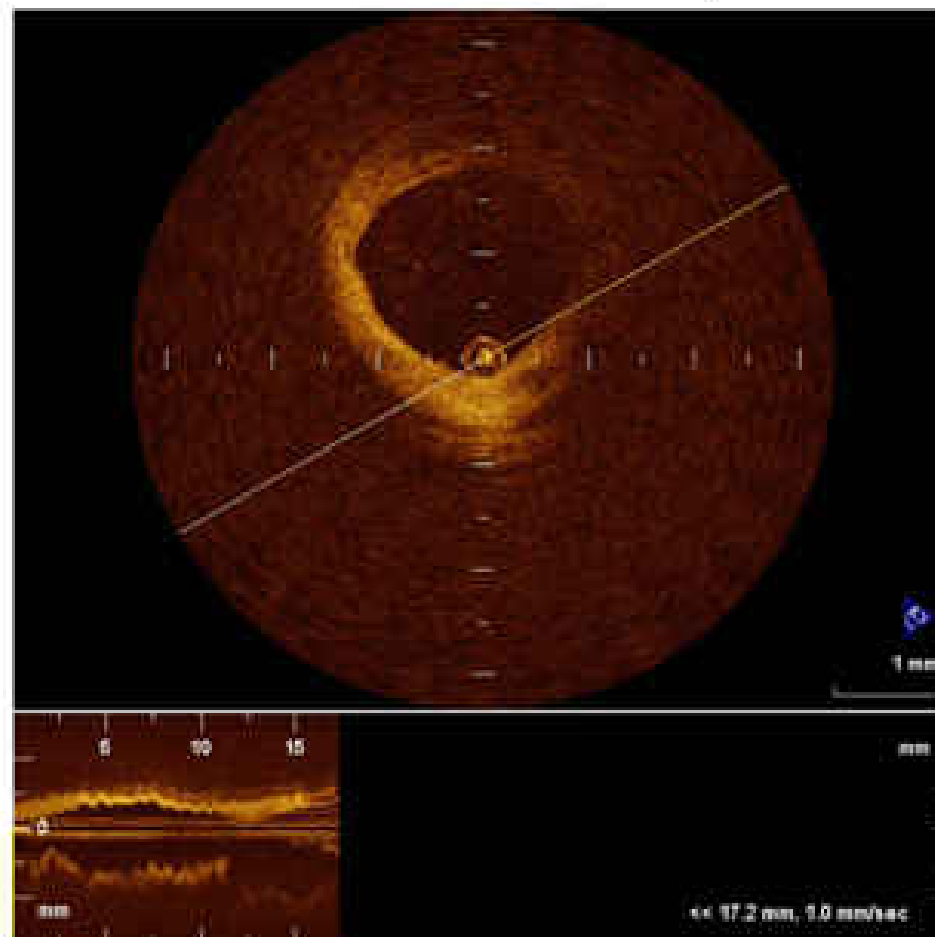


# OCT (HD #1)

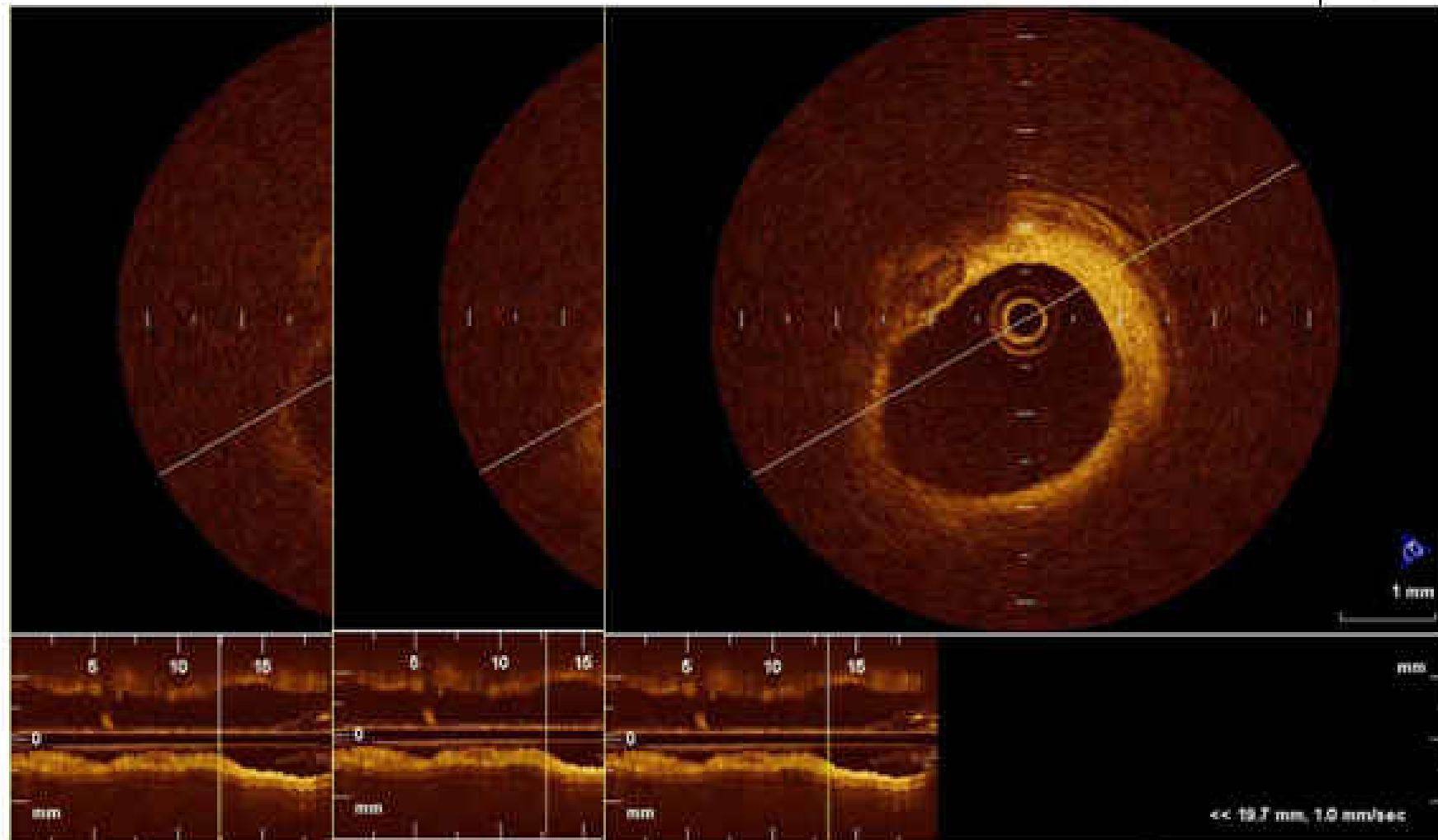
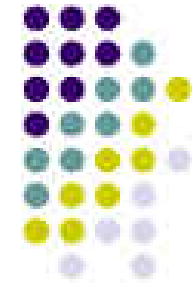




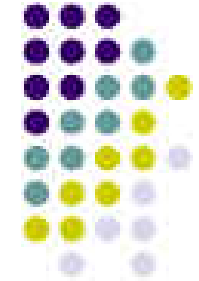
# F/U CAG & OCT(HD 4<sup>th</sup>)



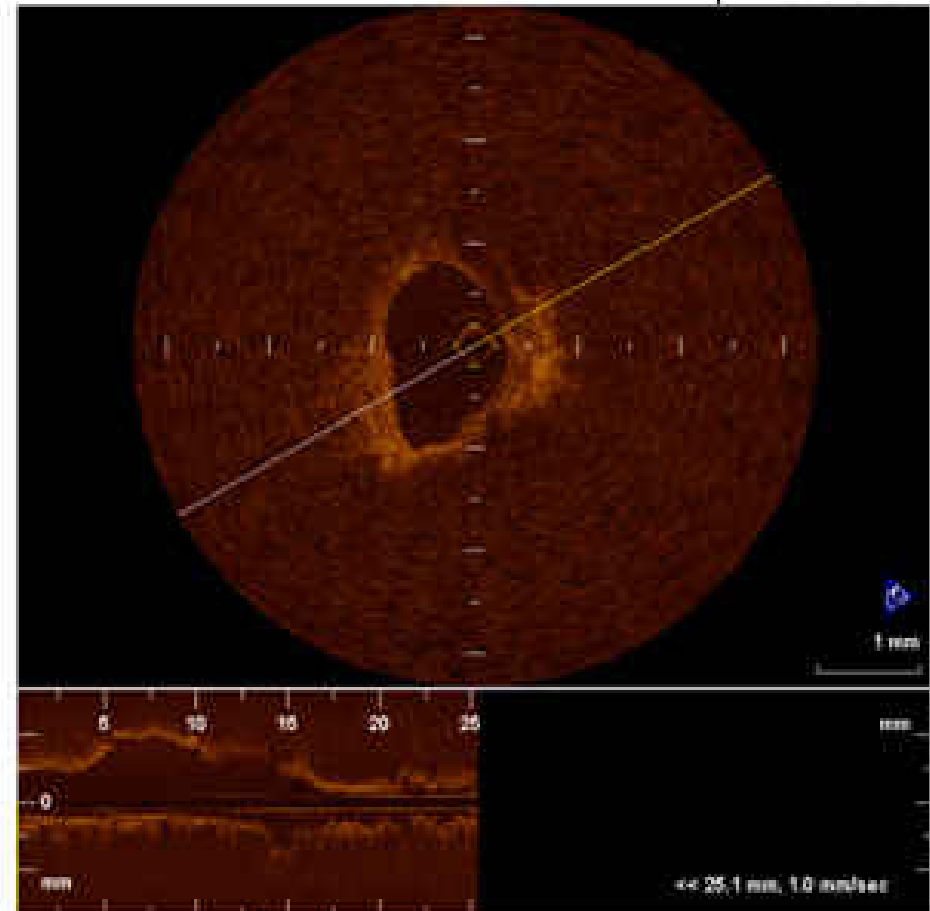
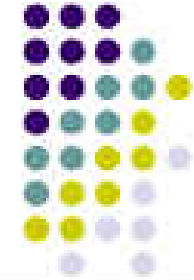
# Still Images



# A Case of Very Late ST(M/46) Recanalization CTO of LAD & RCA

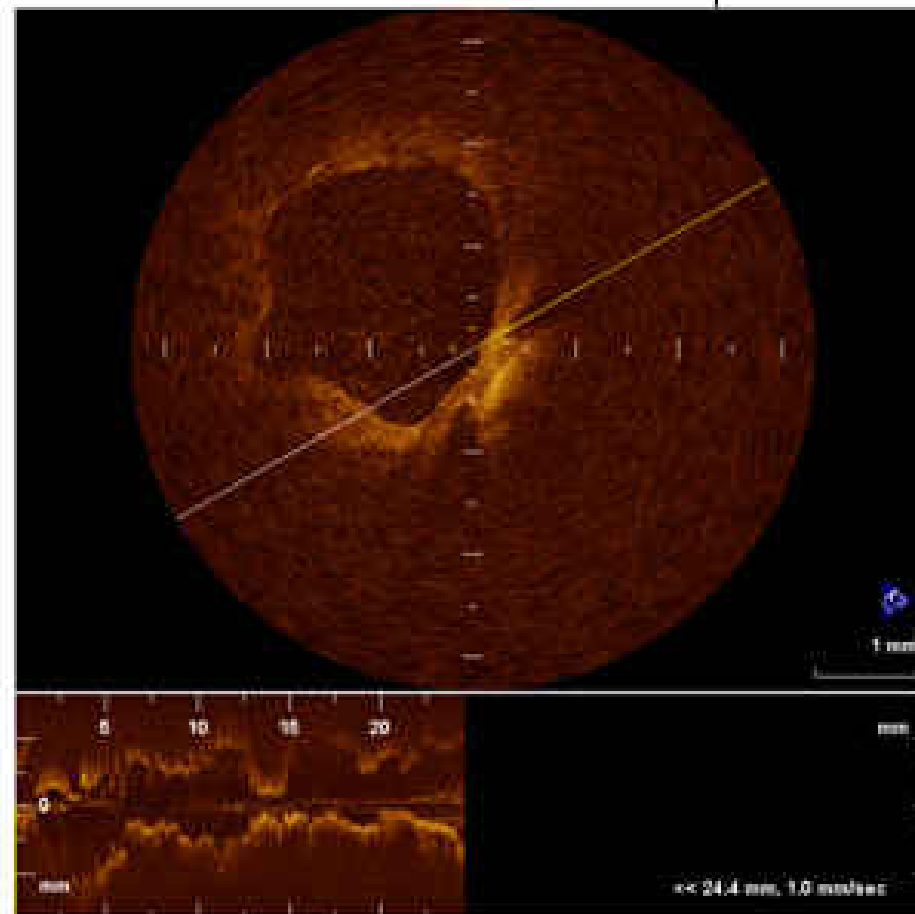


# After 18 M, Discontinue Medication For 3days, Developed Sudden Chest Pain

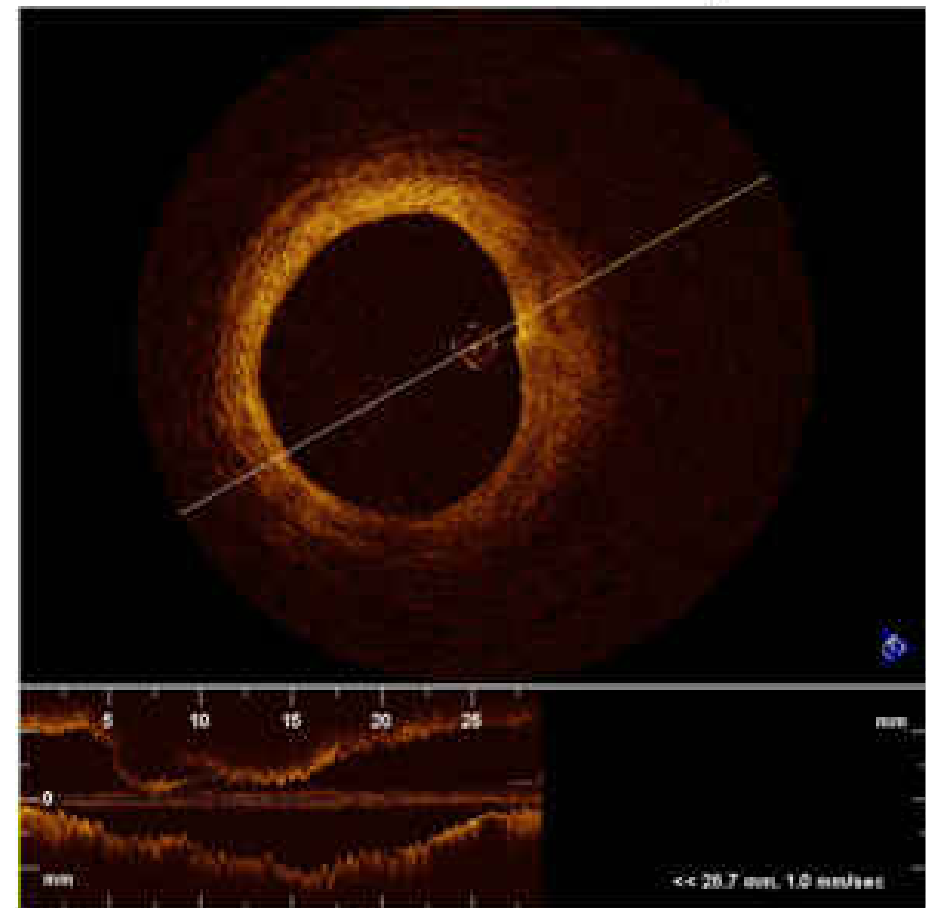
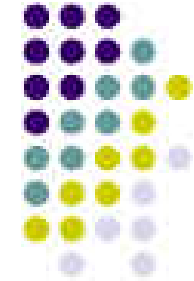




# How about RCA?



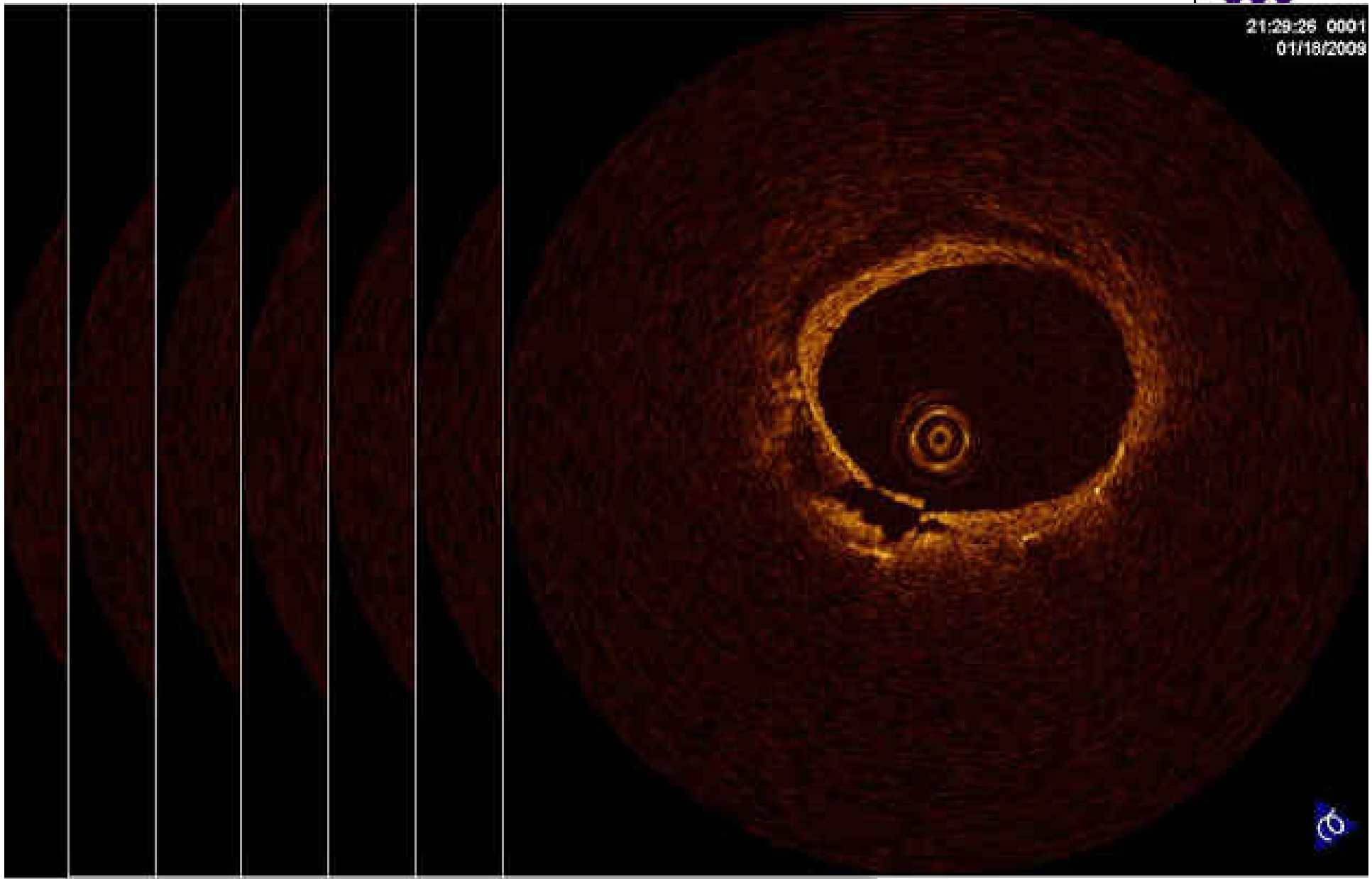
# 69yo male had PCI 3 yrs ago complain severe chest pain & diaphoresis





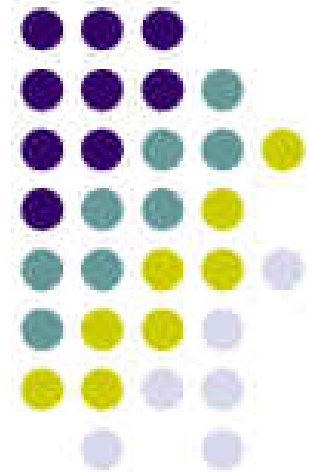


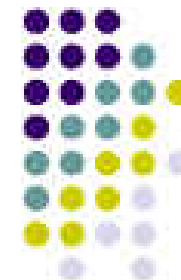
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01/18/2009



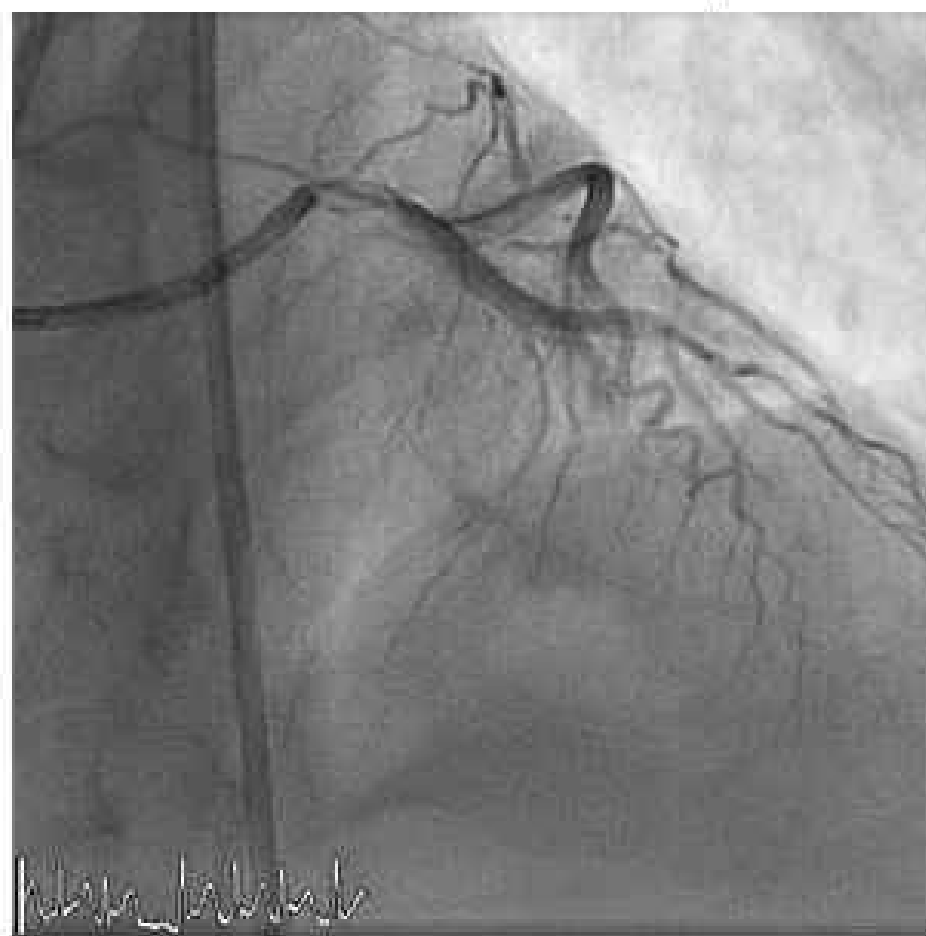
# Complications

- Chest pain
- Dyspnoea
- Arrhythmia
- Hypotension/Shock
- Embolism
- Dissection
- Coronary Spasm
- Thrombus formation
- Perforation
- No reflow
- Slow reflow



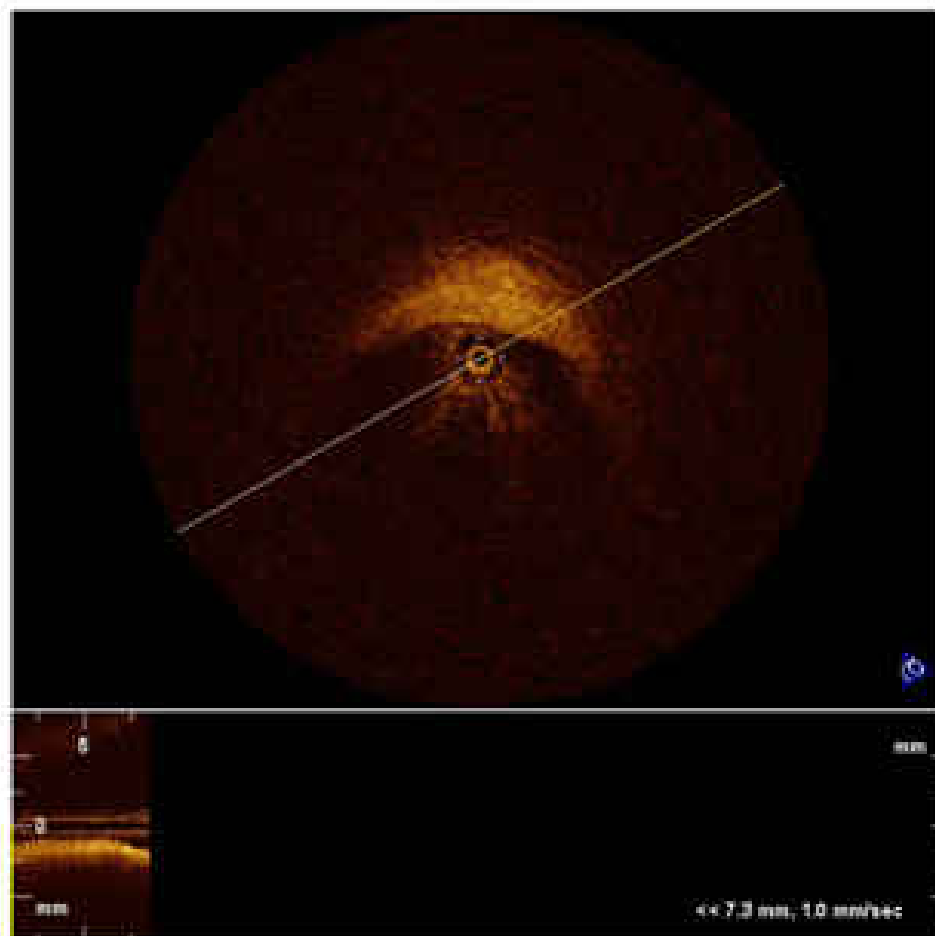


# 42 yo Male, NSTEMI



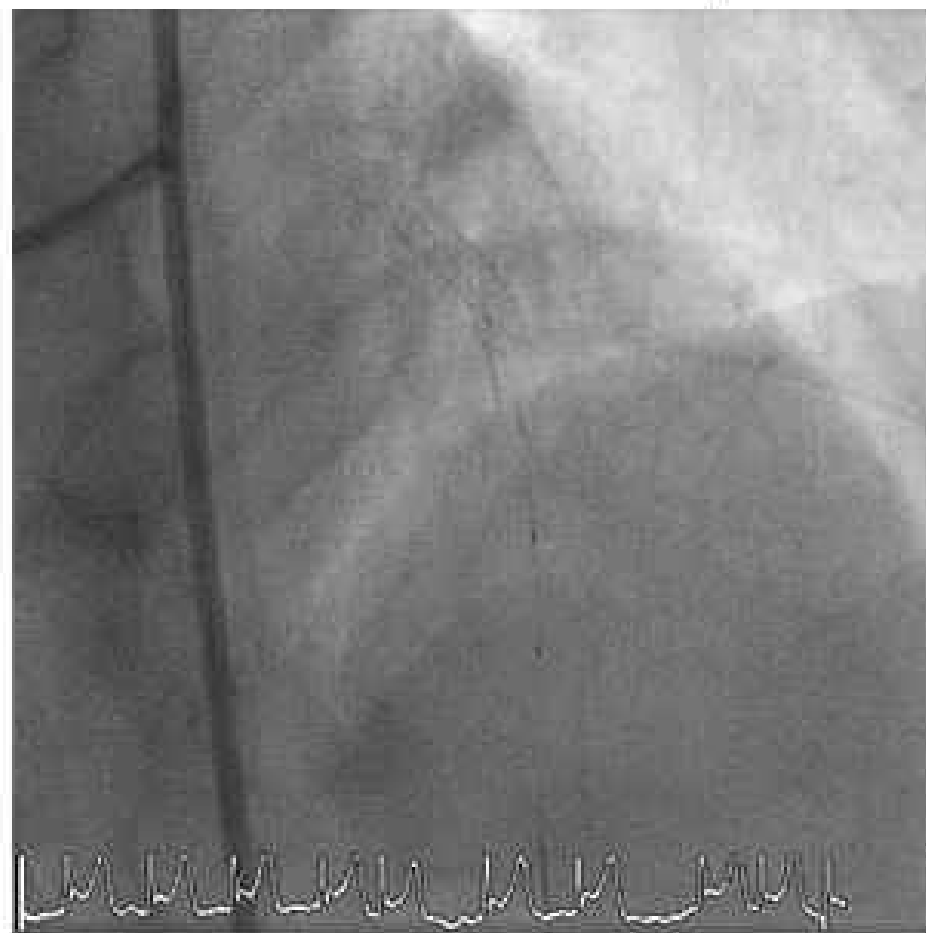
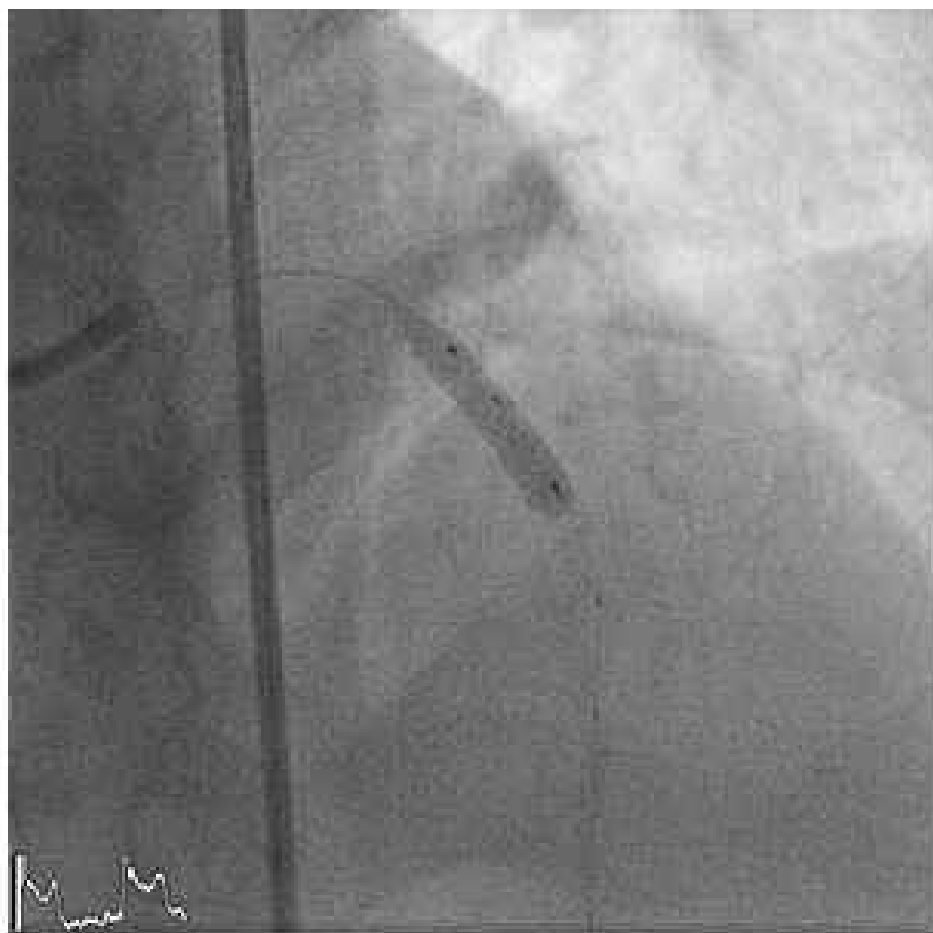


# Disappointing OCT Images



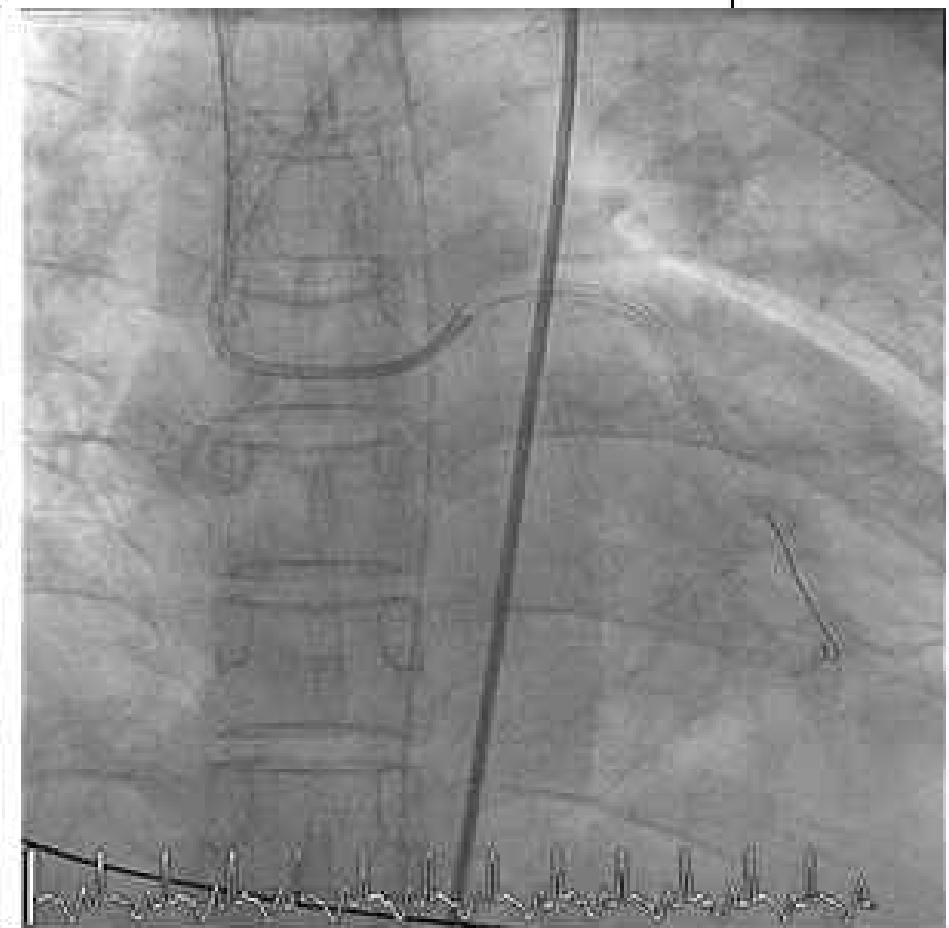
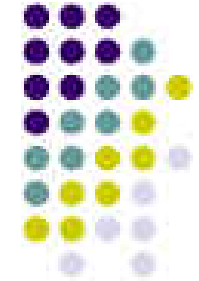


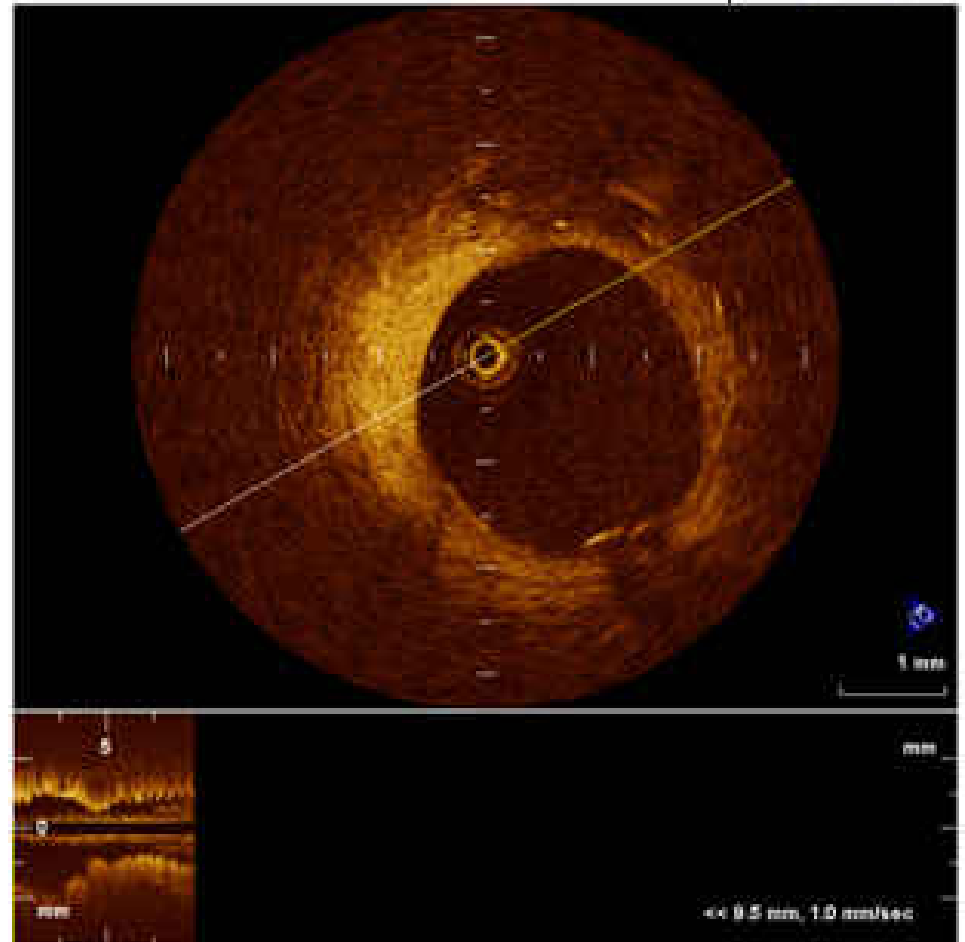
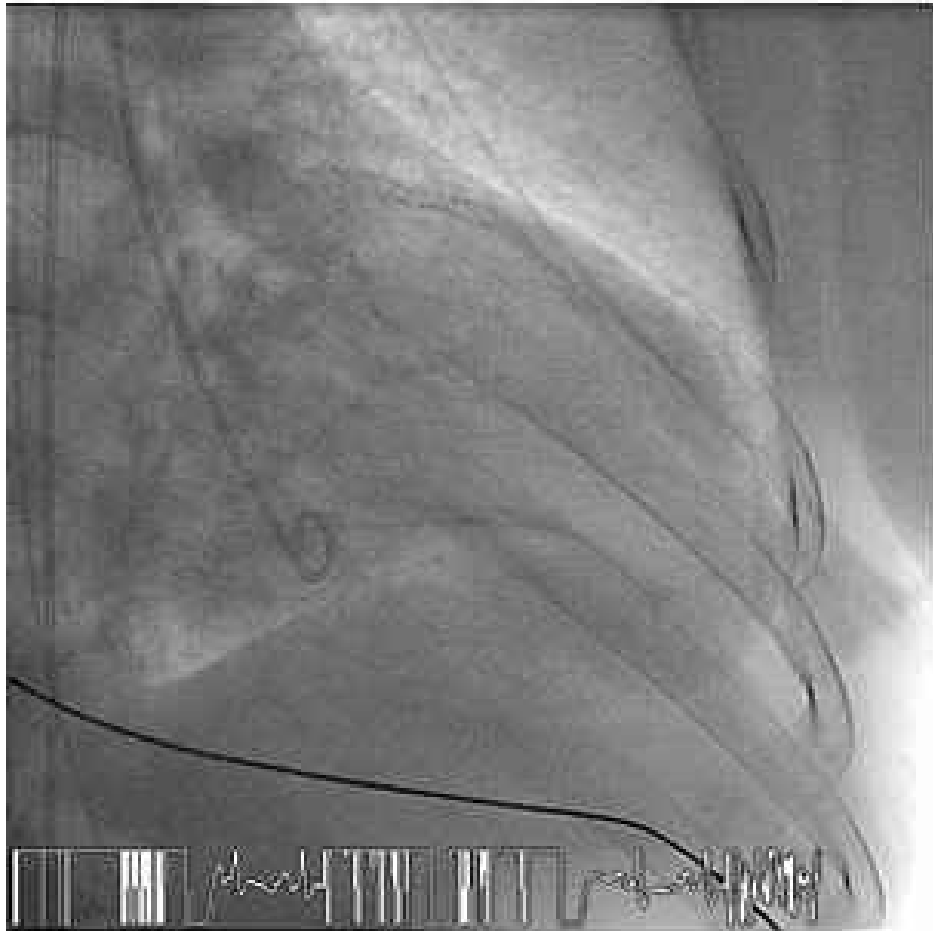
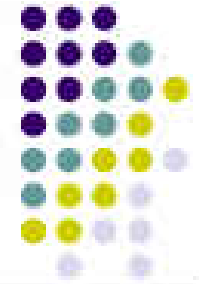
# Bail Out! Direct Stenting

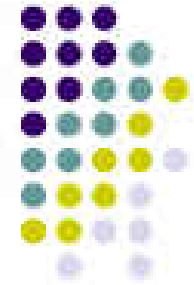


# Feasibility of OCT in ACS

## A Case of Aborted SCD



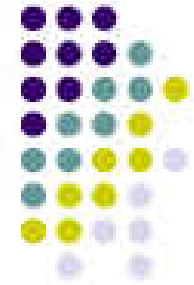




# Summary

- Treating ACS
  - OCT cannot fully replace the role of IVUS
  - Could be done safely in selected case
  - Currently, OCT is the best option to determine
    - Coronary lesion characteristics
    - Outcome of PCI
    - Detection of vulnerable plaque





**Thank you for your  
attention!**