Practical Pitfalls of OCT in Plaque Characterization: SA vs. ACS

Kenichi Fujii, MD
Hyogo College of Medicine, JAPAN

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Hyogo College of Medicine

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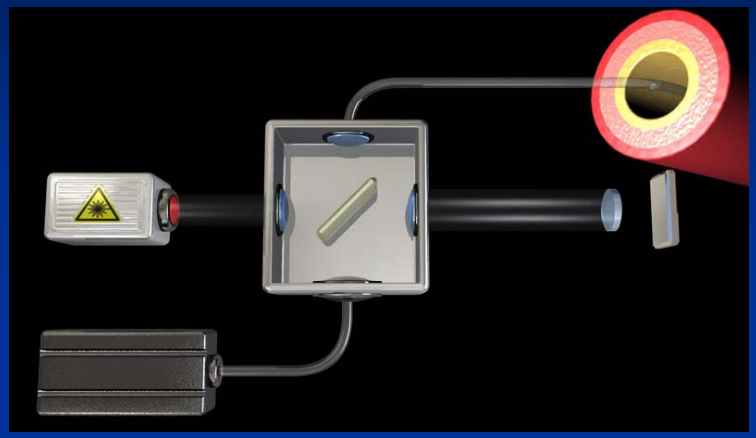
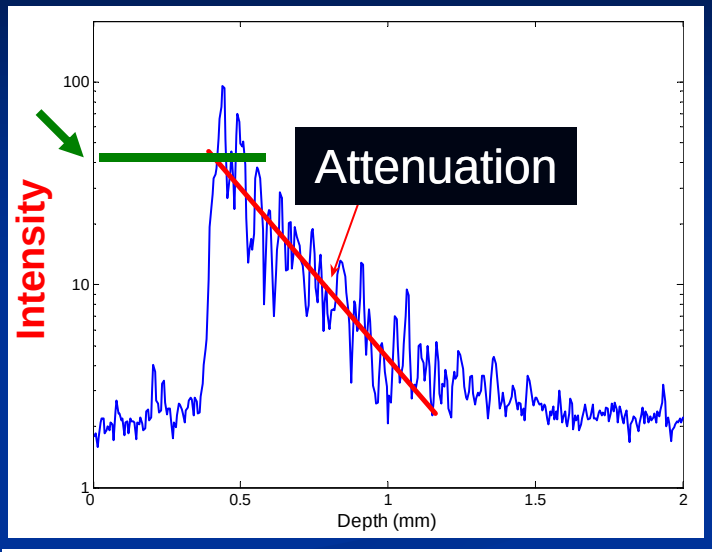
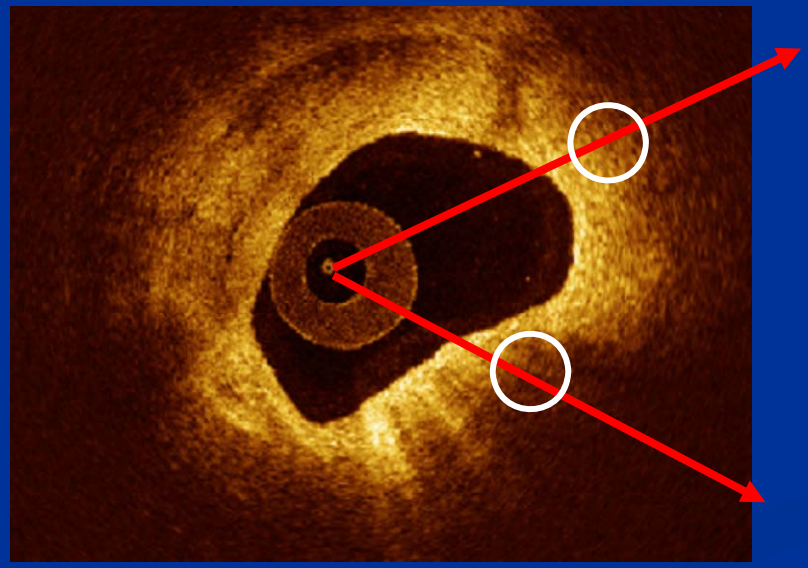
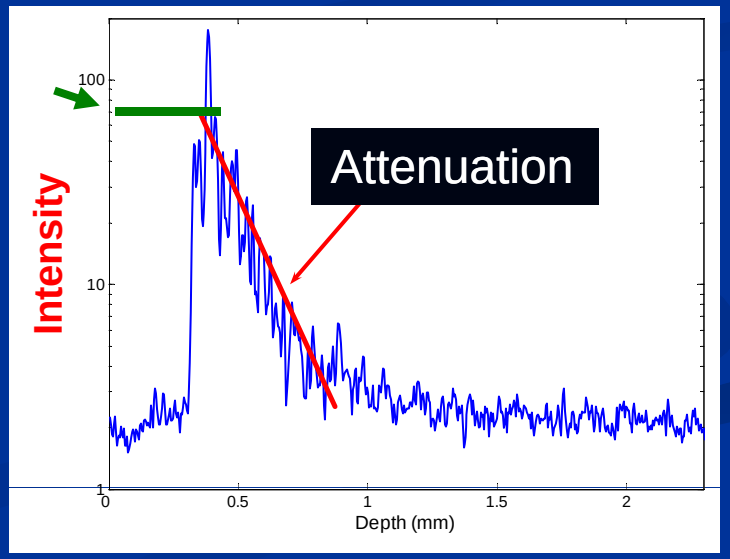
2. Plaque characterization in SA pts
3. Pitfalls and artifacts

OCT Image Features



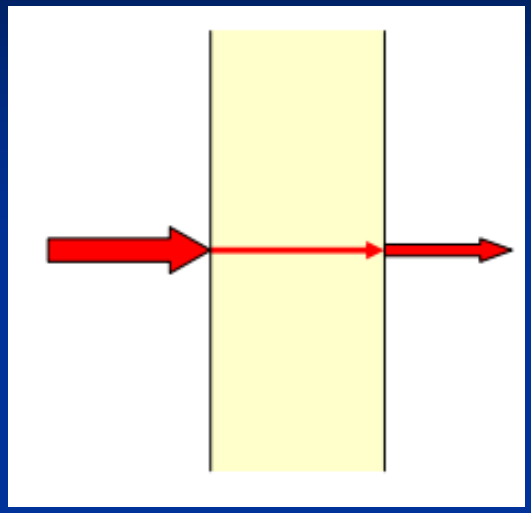


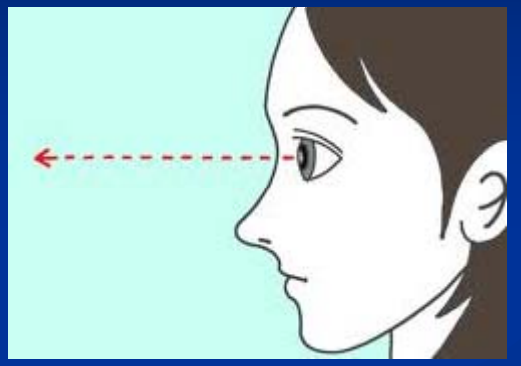




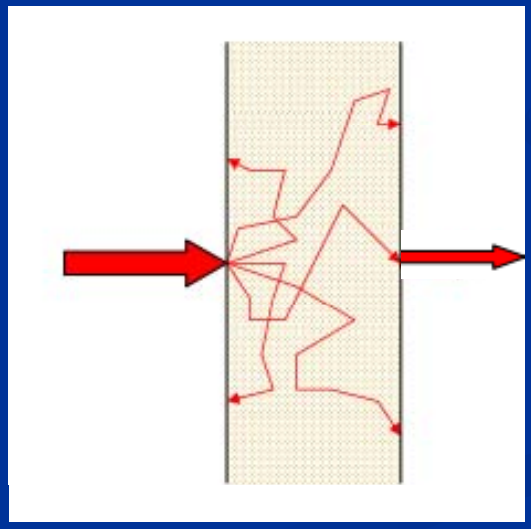
Light attenuation

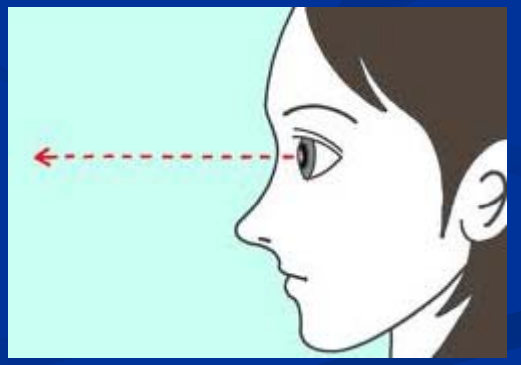
Absorption



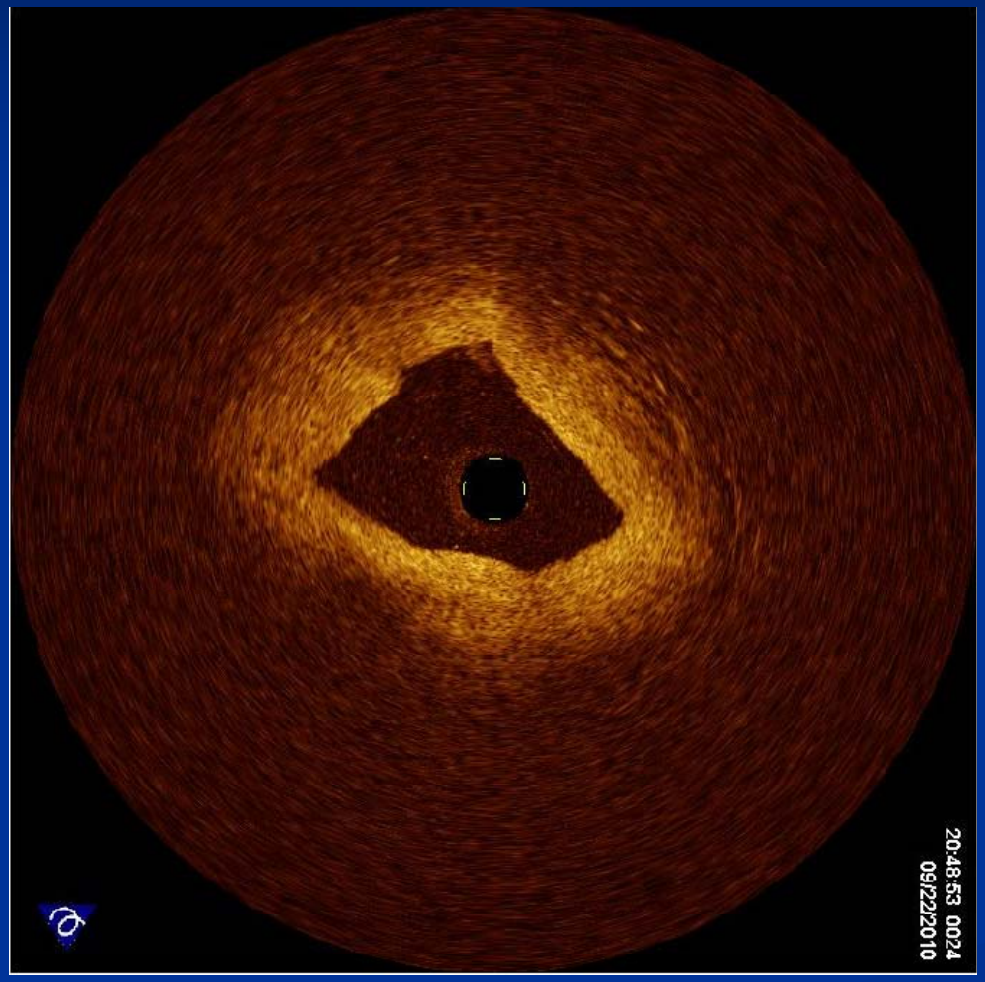


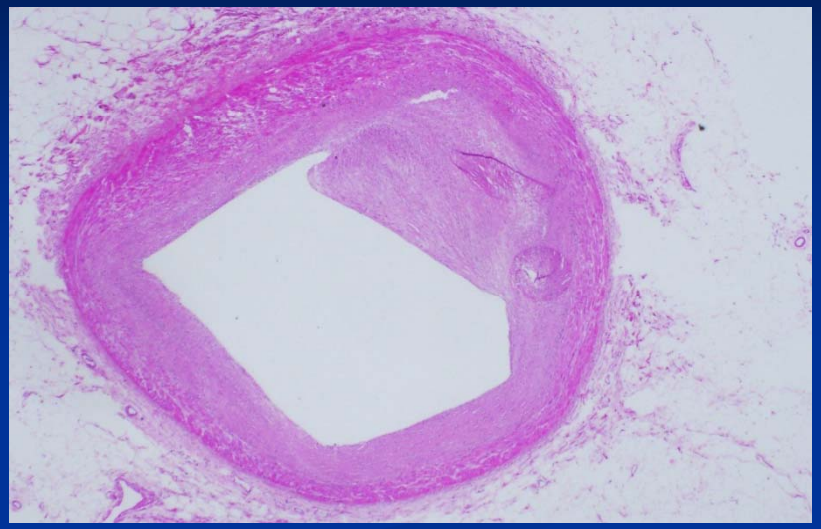
Scattering

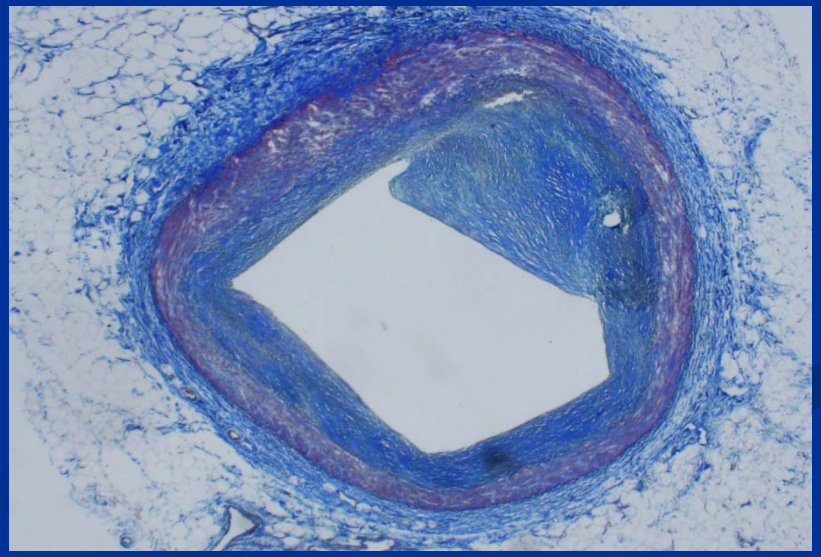




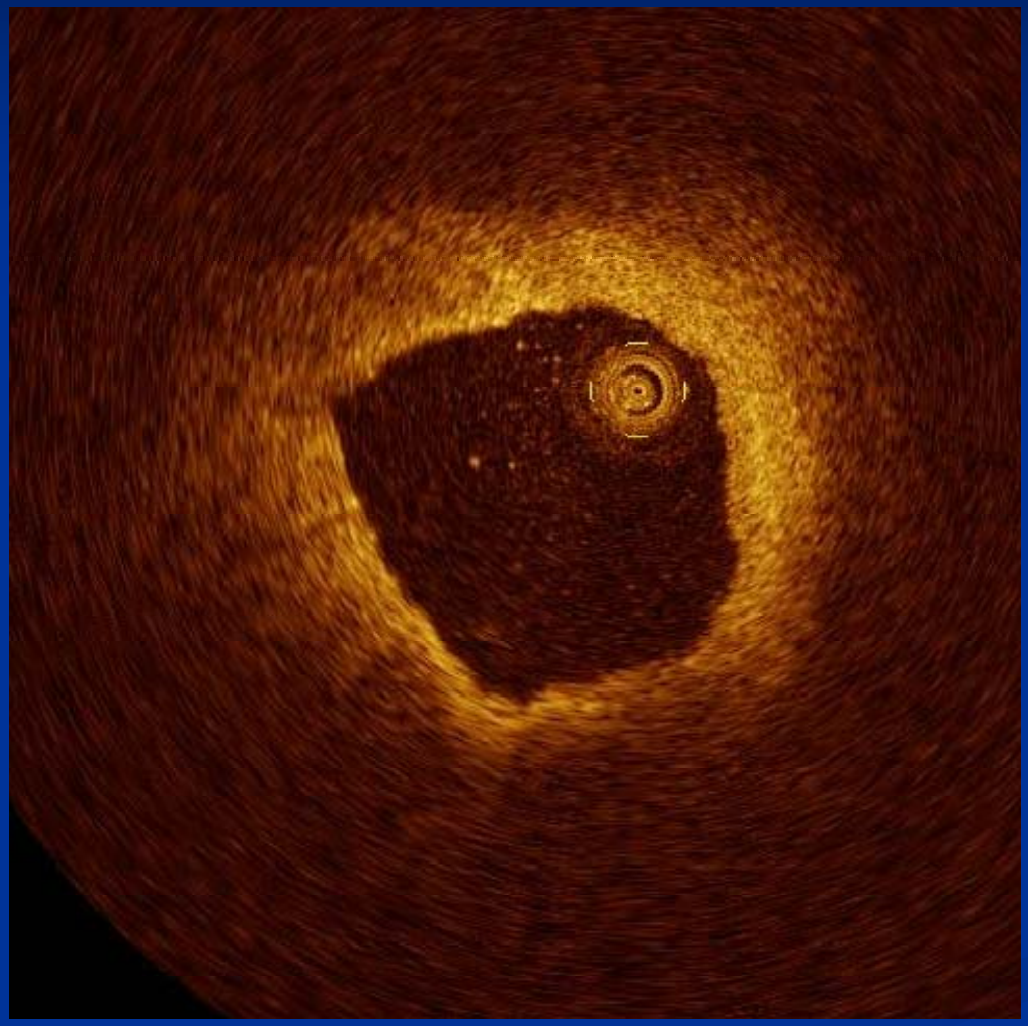
Stable fibrous tissue

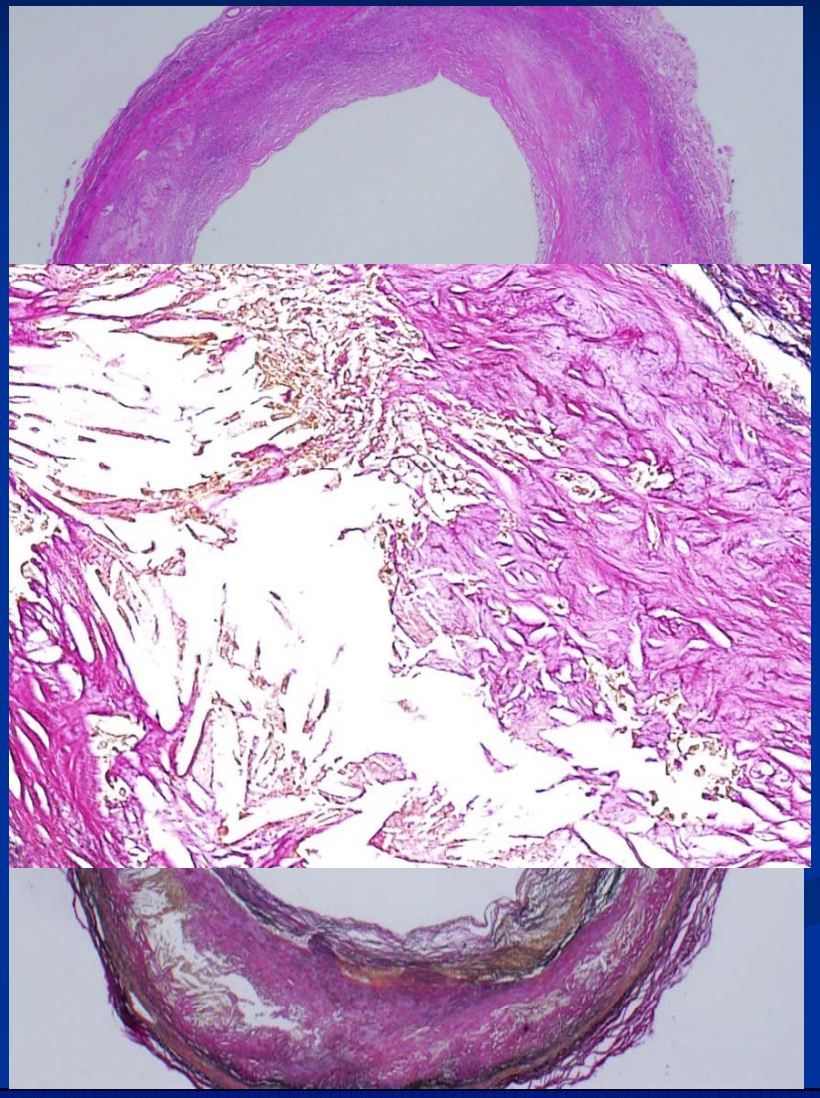




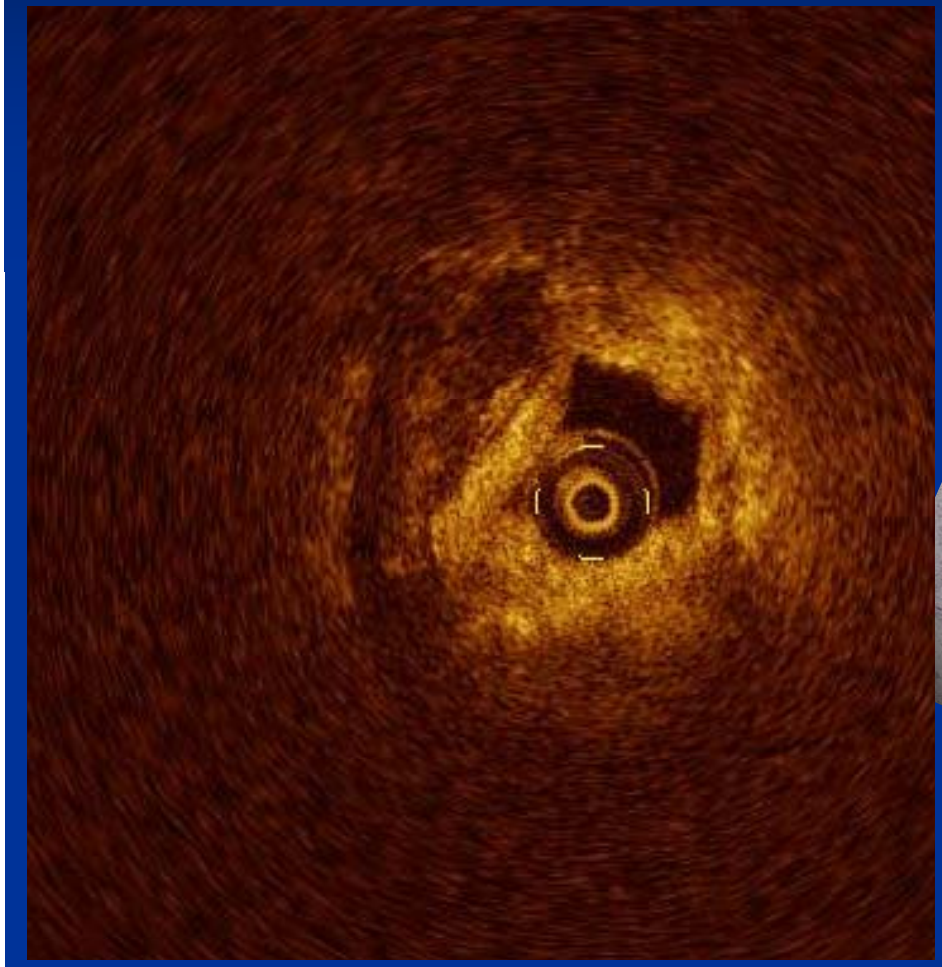


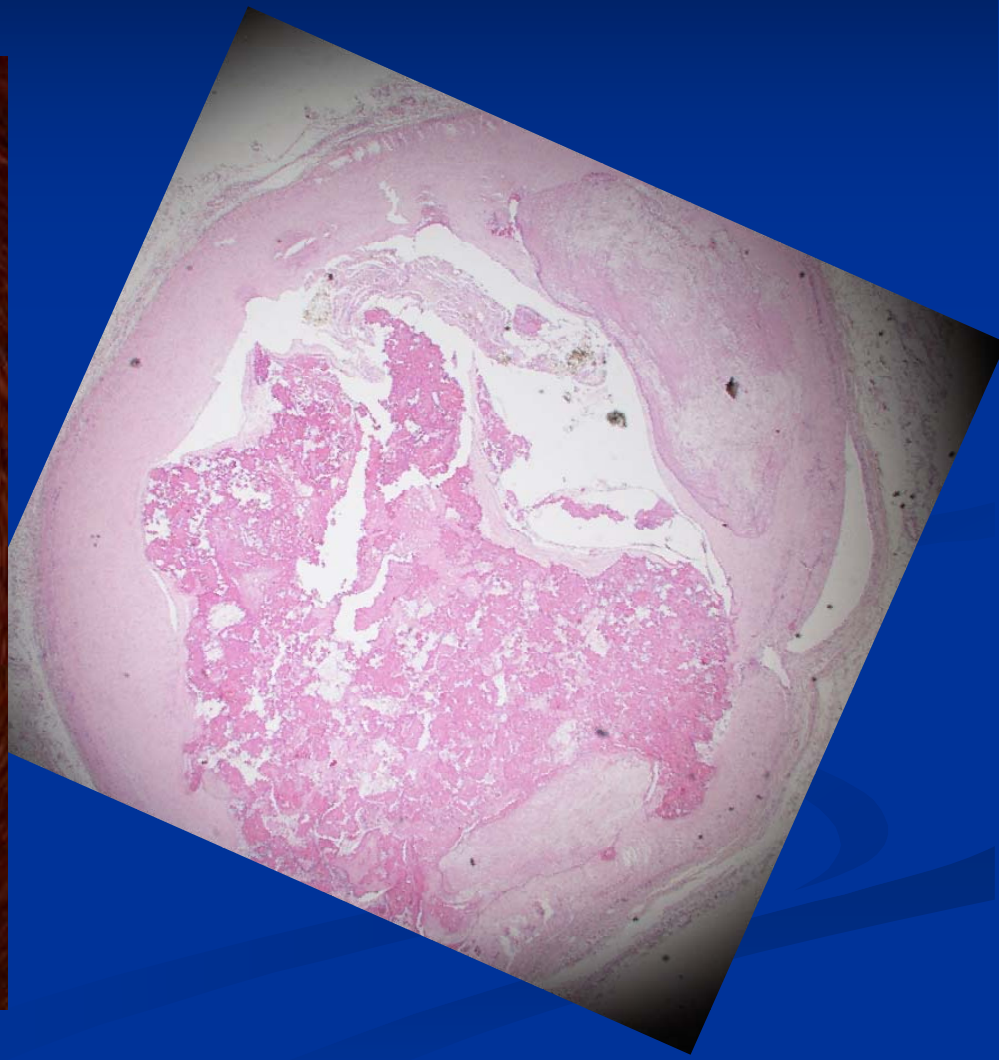
Lipidic plaque





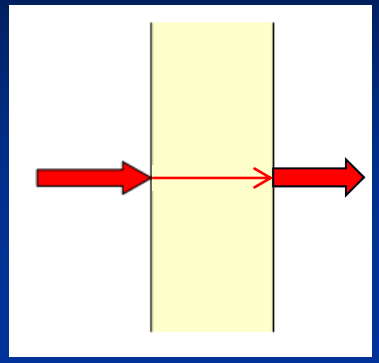
Calcified plaque





Light attenuation

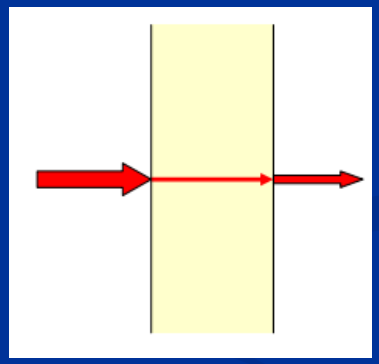
Low attenuation



- Fibrous

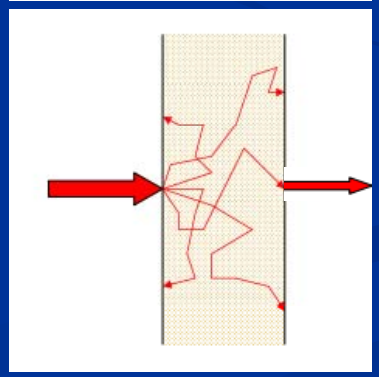
High attenuation

Absorption



- Lipid
- (Hemoglobin)

Scattering



- Calcium

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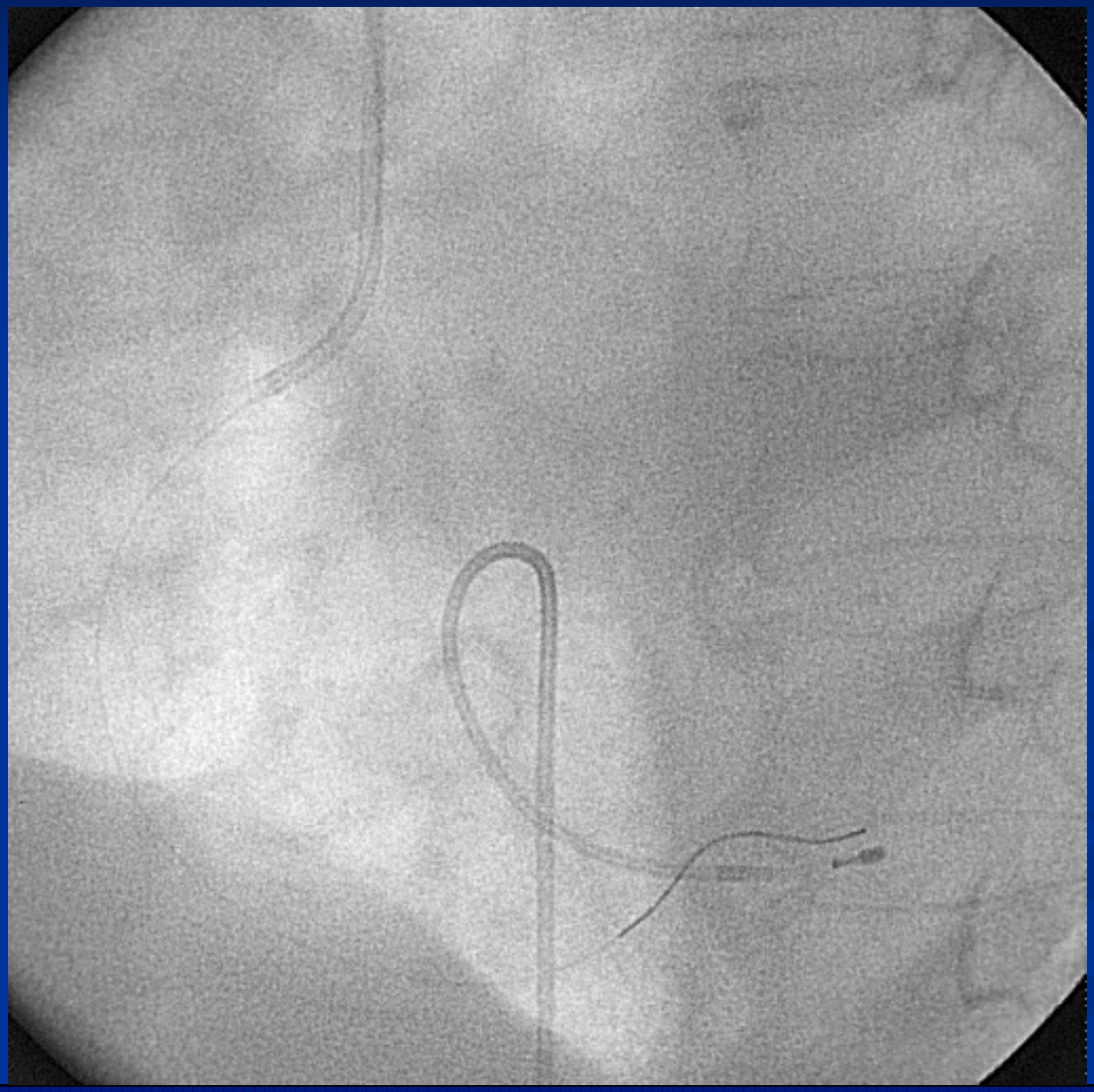
Case: Acute Myocardial Infarction



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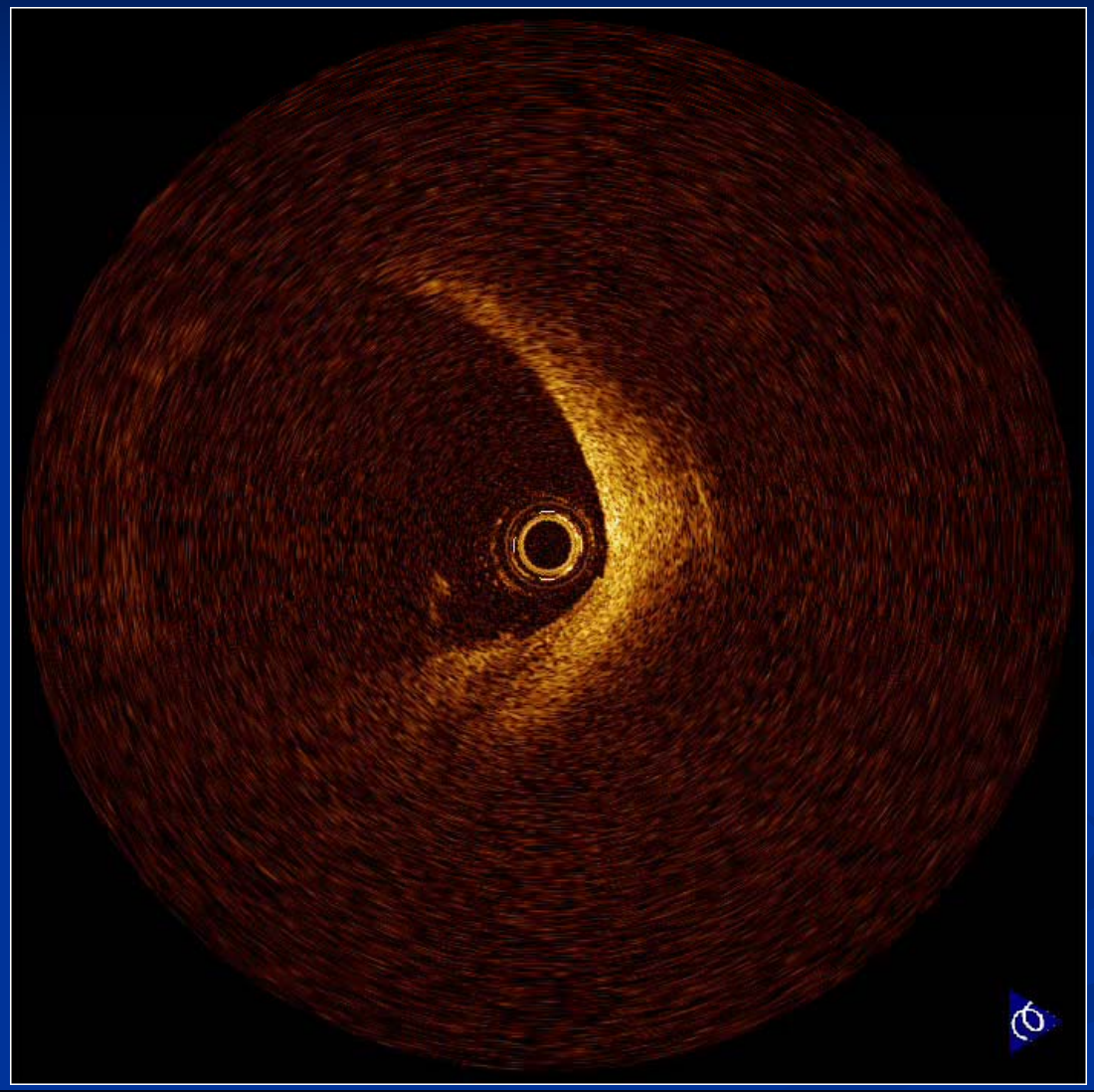

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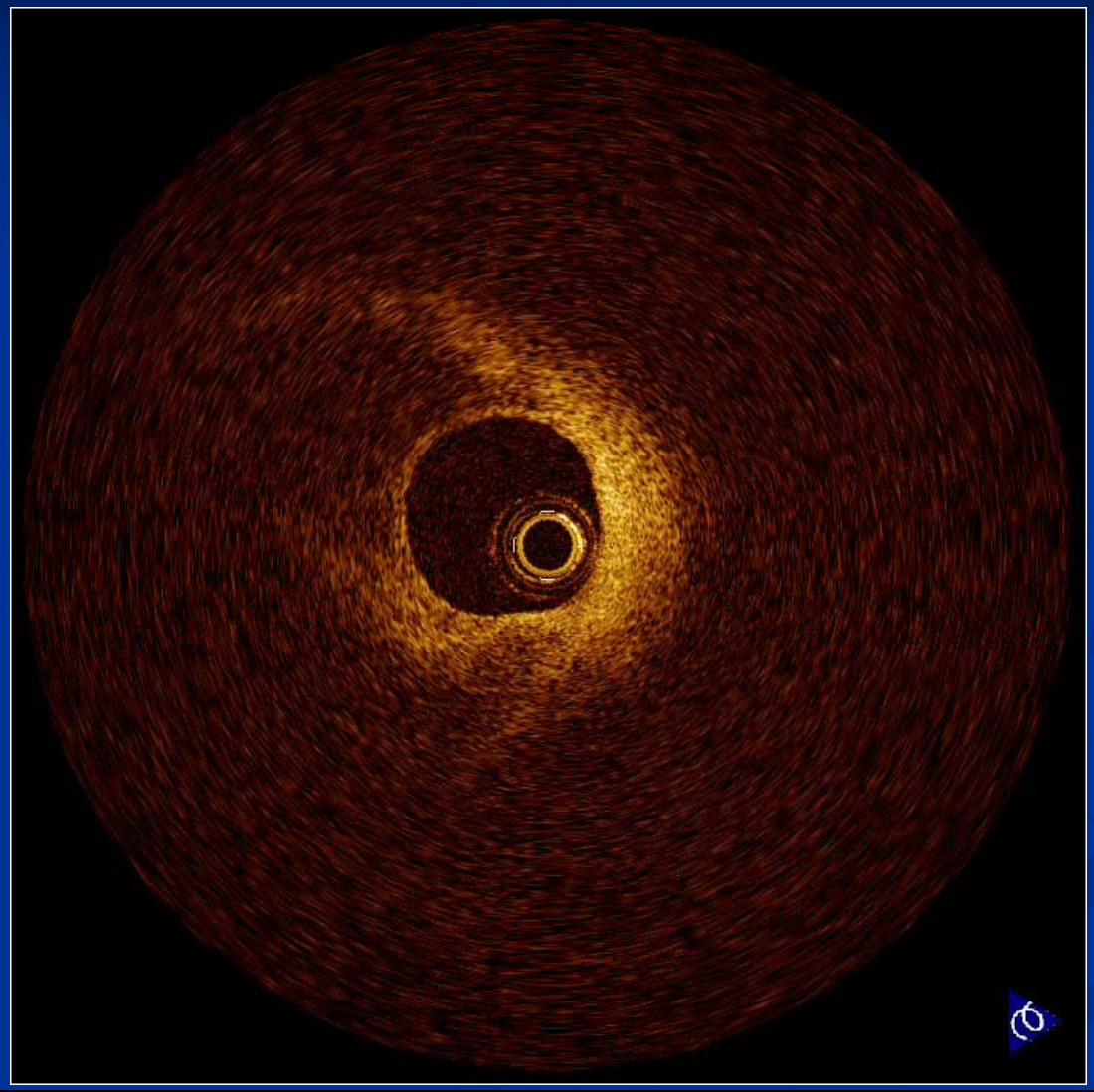

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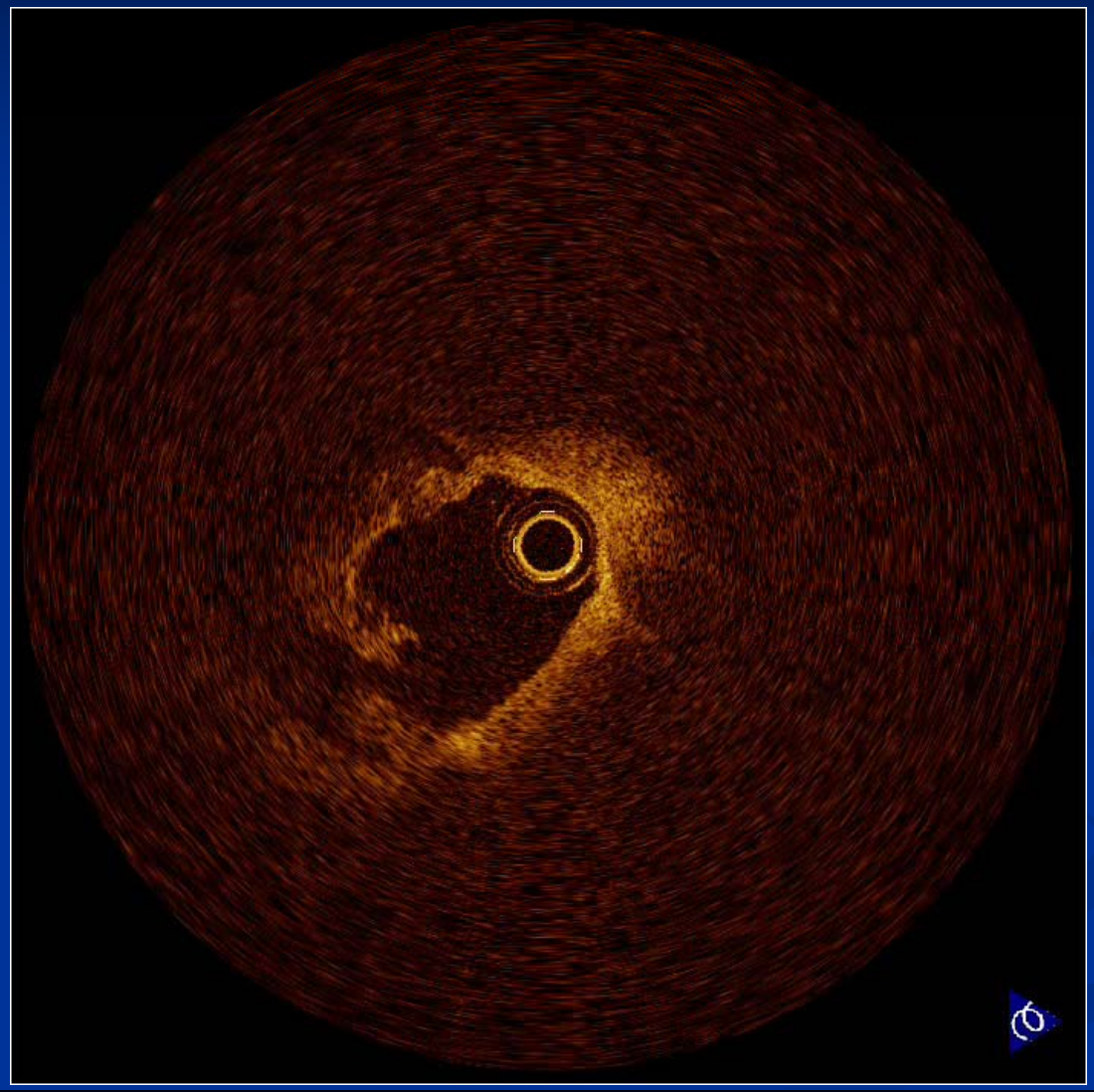
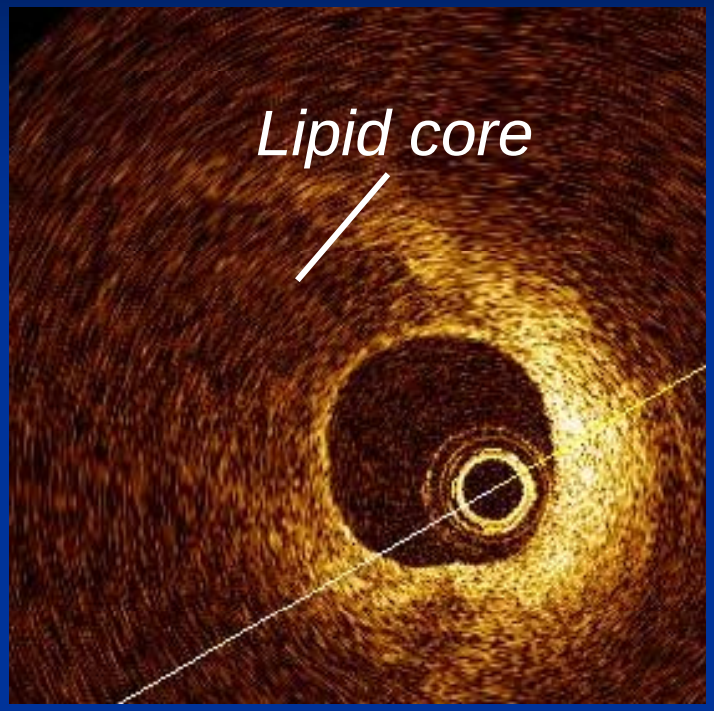
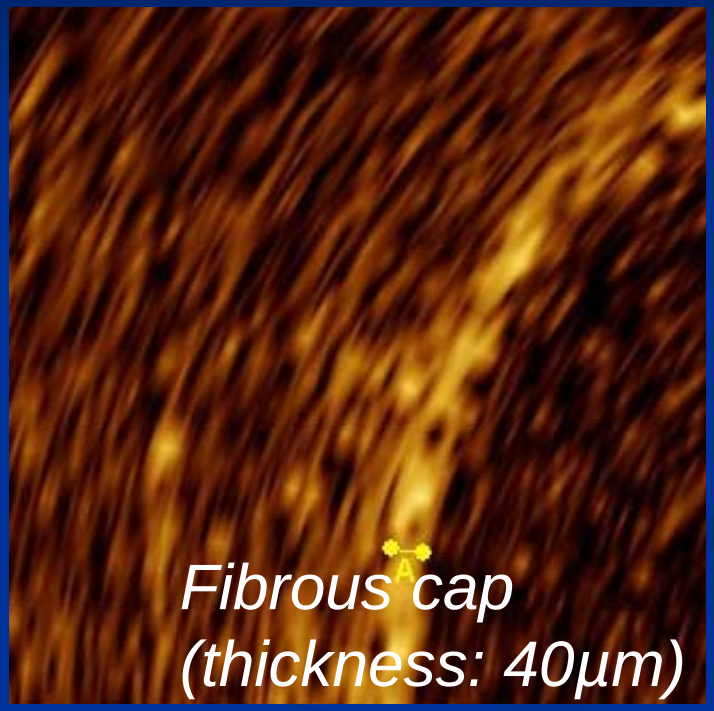


Thin-cap fibroatheroma (TCFA)





TCFA as a plaque with lipid content (1 quadrant within a plaque) and the thinnest part of a fibrous cap measuring <65 μm.

Fujii K, et al. J Am Coll Cardiol. 2008;52:787-8.

Intracoronary thrombus

Red thrombus: high OCT signal attenuation

White thrombus: relatively low OCT signal attenuation

Kume T, et al. Am J Cardiol. 2006;97:1713-17.

Histopathological validation

Left coronary artery

Right coronary artery

- ✓ The surrounding fat were dissected from each specimens carefully.

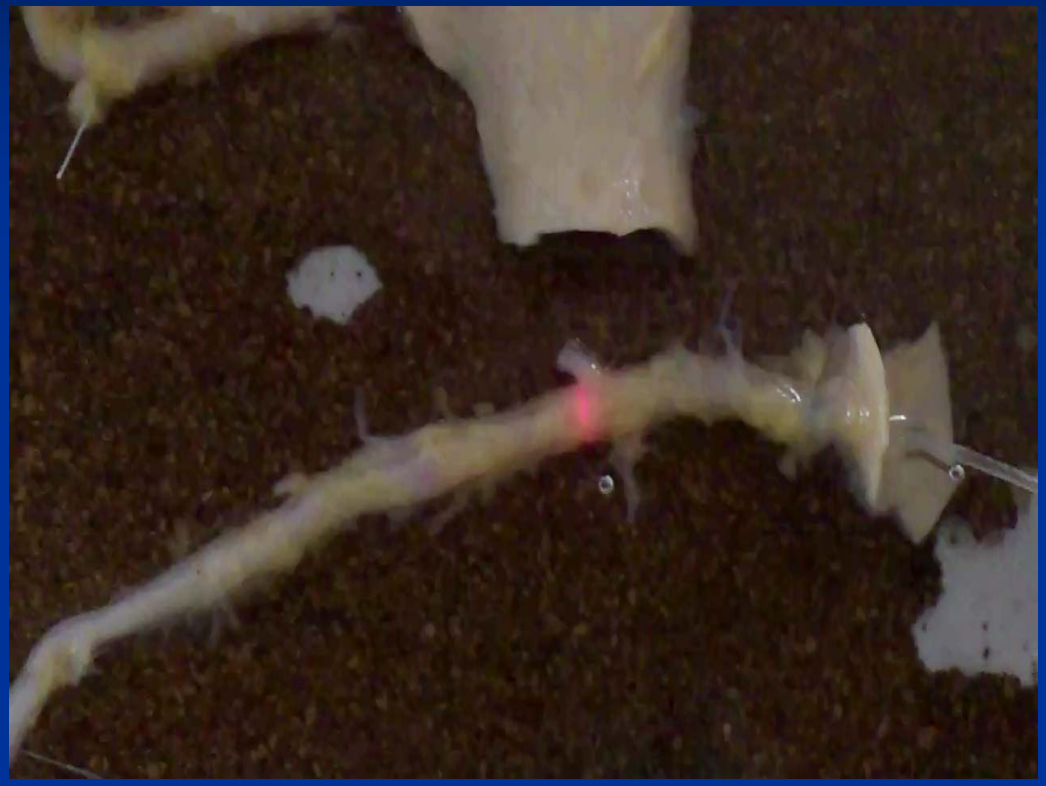
Histopathological validation

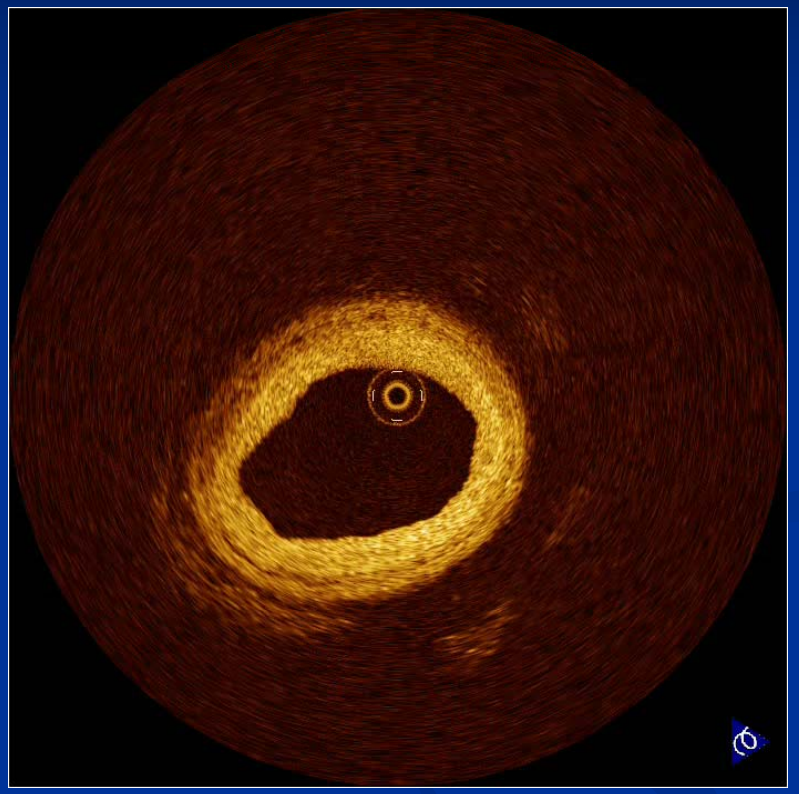
- ✓ The side branches were tied off with sutures.

Histopathological validation

- ✓ OCT imaging wire from LightLab Imaging, Inc.
- ✓ OCT examinations with balloon occlusion method.
- ✓ Pullback (1.0mm/s) during lactated Ringer's infusion.
- ✓ Imaging of the whole coronary artery step-by-step every 50mm length from the distal end to the ostium.

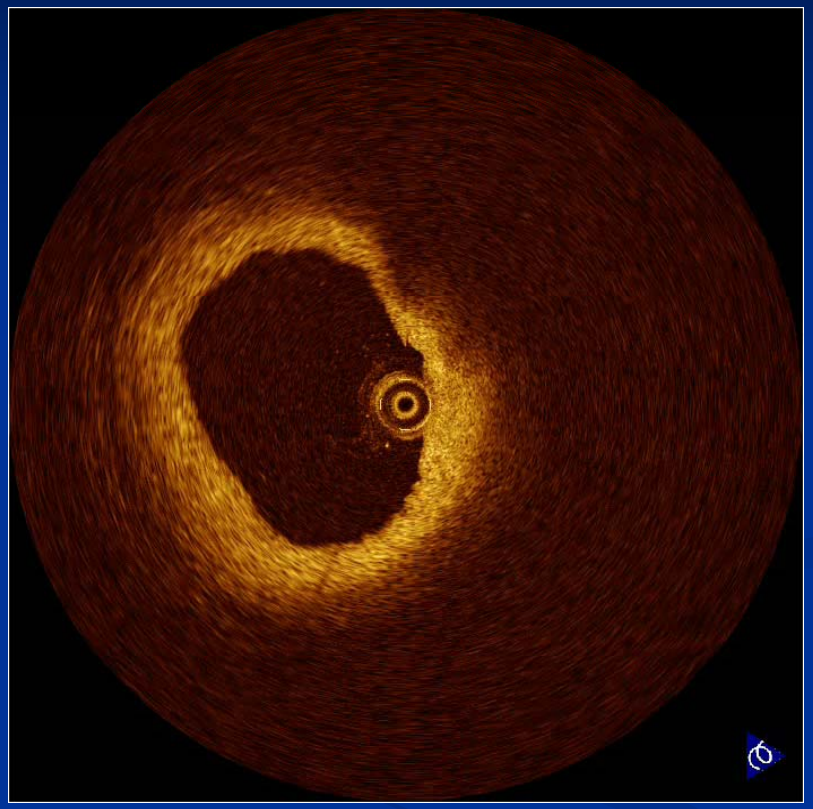
Histopathological validation





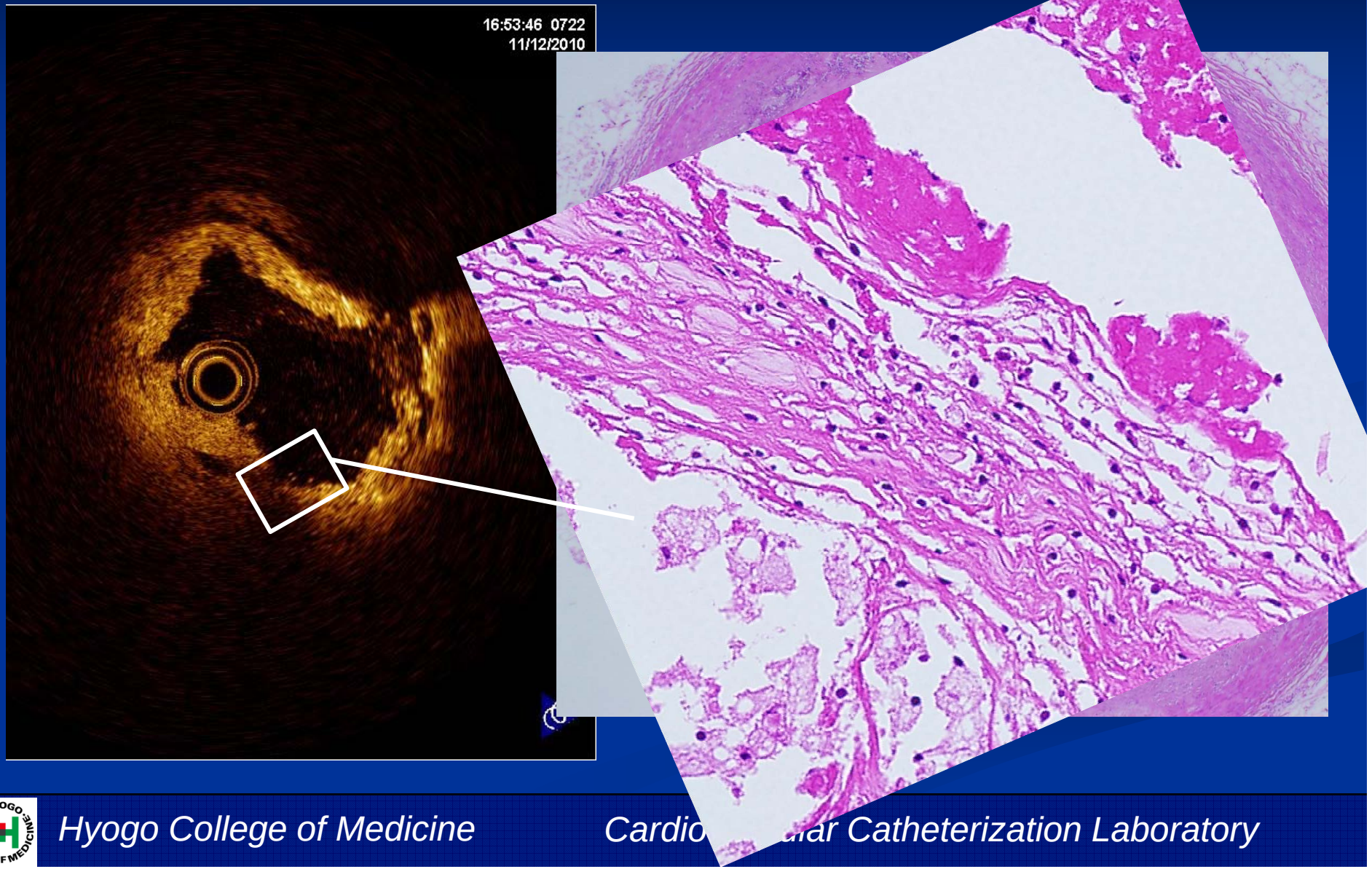
- ✓ The position of the interrogating beam on the tissue was monitored by a visible light beam.

Histopathological validation

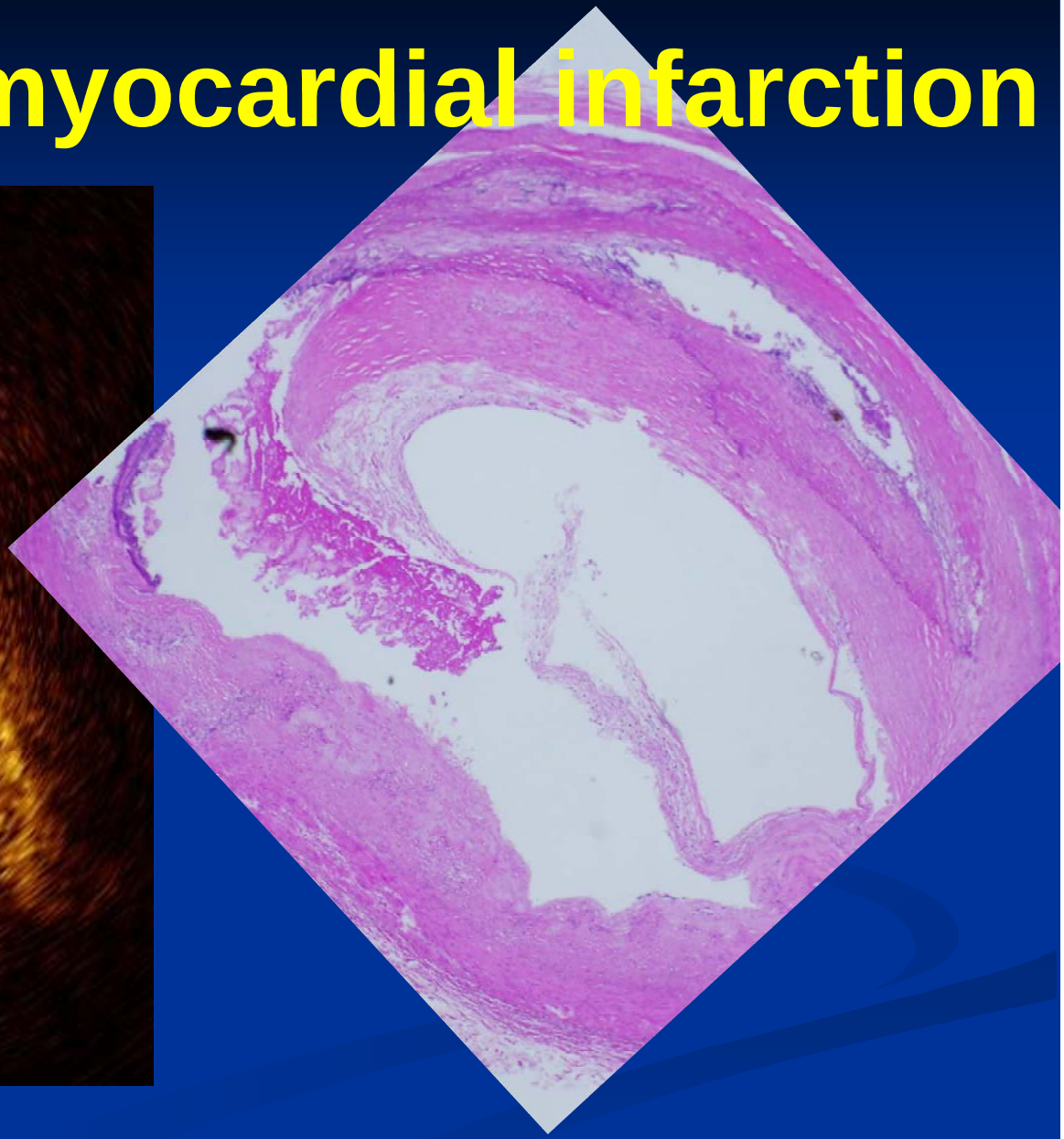


- ✓ To clarify the cross sectional position of the region of interest, surgical needle with thread were carefully inserted in the coronary arteries.

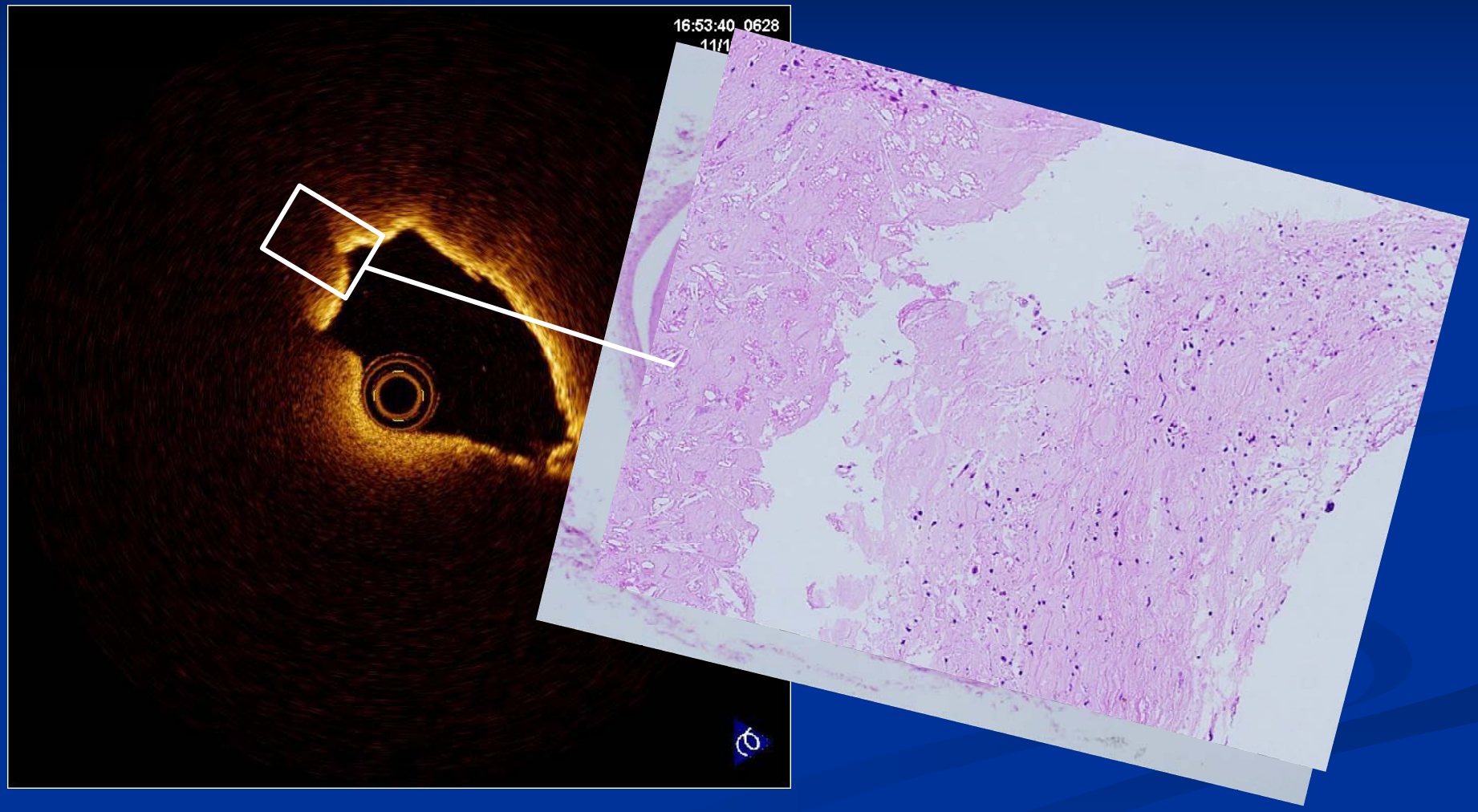
Case: acute myocardial infarction



Case: acute myocardial infarction



Case: acute myocardial infarction



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Background

Previous reports of TCFA frequency using intracoronary OCT have suggested much higher frequencies in patients with stable angina.

	n	Ruptured Plaque	Fibrous Cap Atheroma	
			Cap <65 μm	65 μm ≤ Cap <100 μm
Non-CV	13	4 (0.31)	4 (0.31)	3 (0.23)
(+) rupture	14	19 (1.36)	17 (1.21)	4 (0.29)
(−) rupture	36	0 (0)	6 (0.17)	19 (0.53)

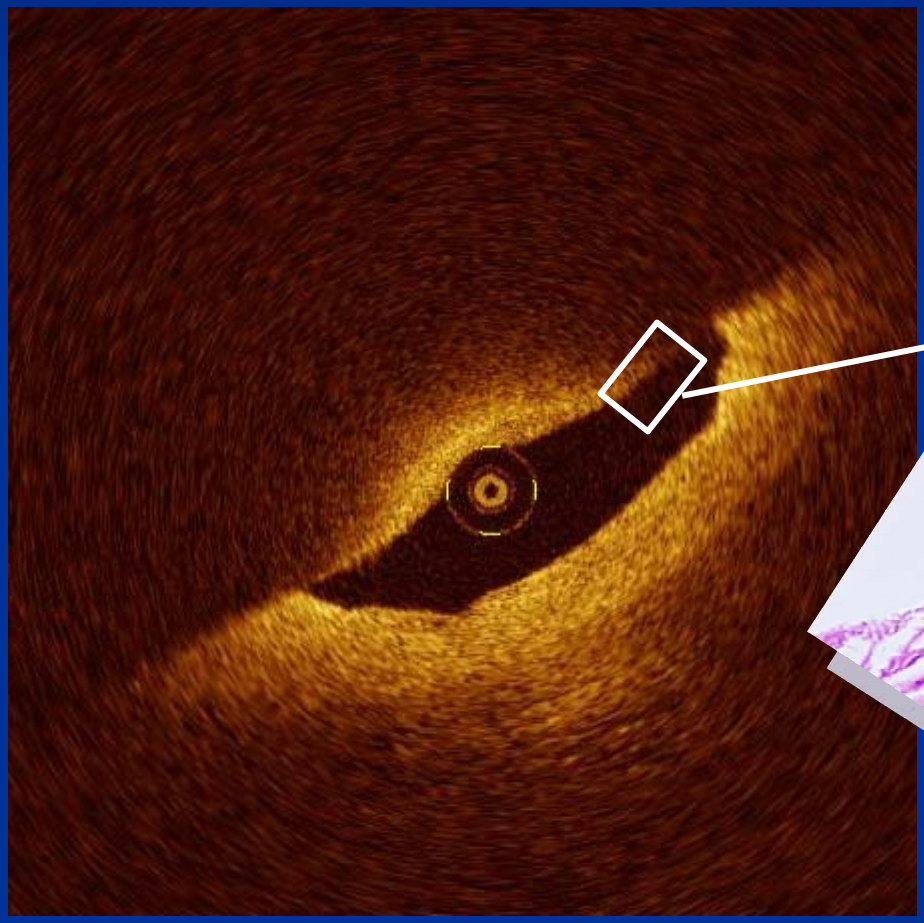
Schmermund A, et al. Atherosclerosis. 2001;155:499-508.

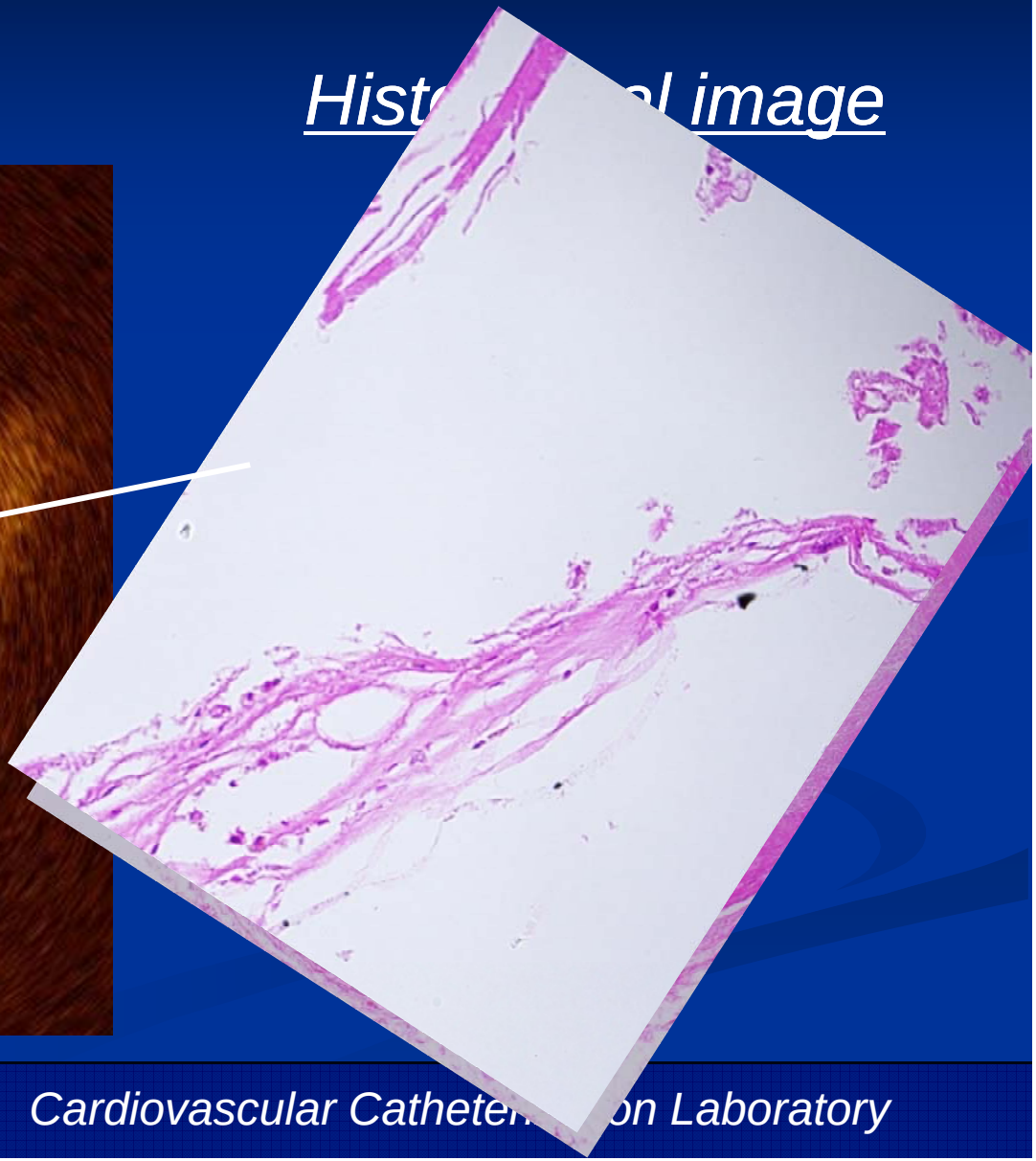
Cheruvu PK et al. J Am Coll Cardiol. 2007;50:940-9.

Case 1: non ACS

OCT image

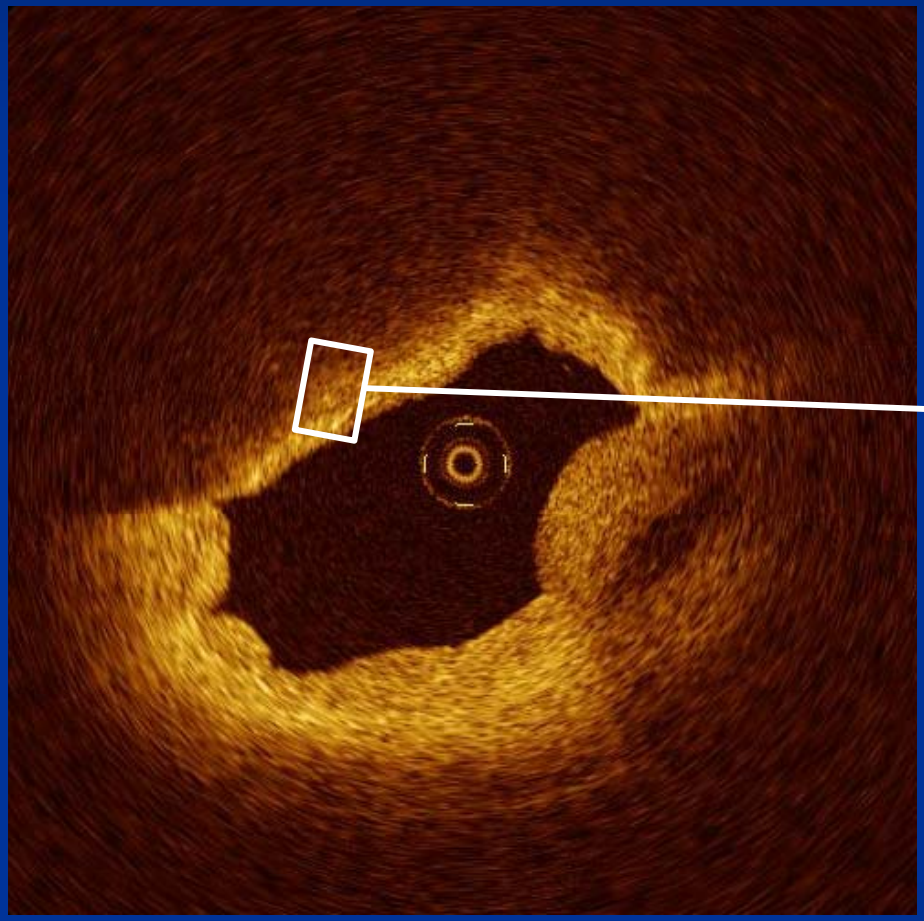
Histo l image



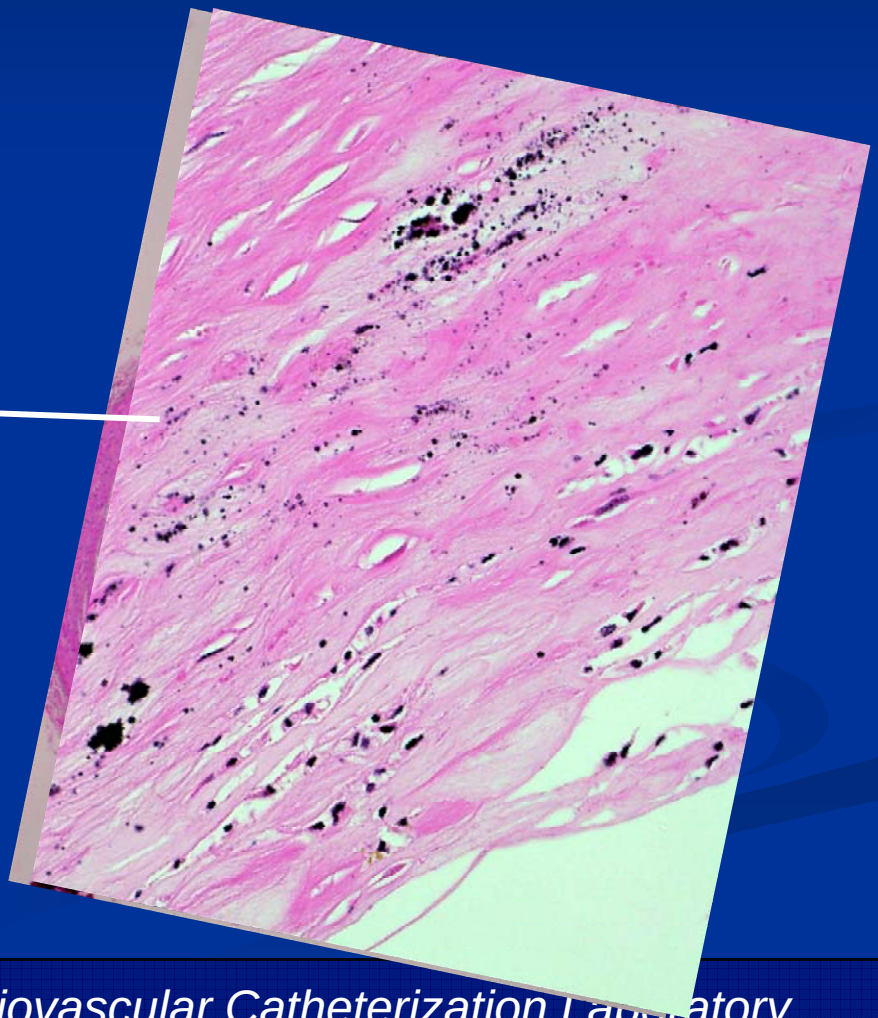


Case 2: non ACS

OCT image



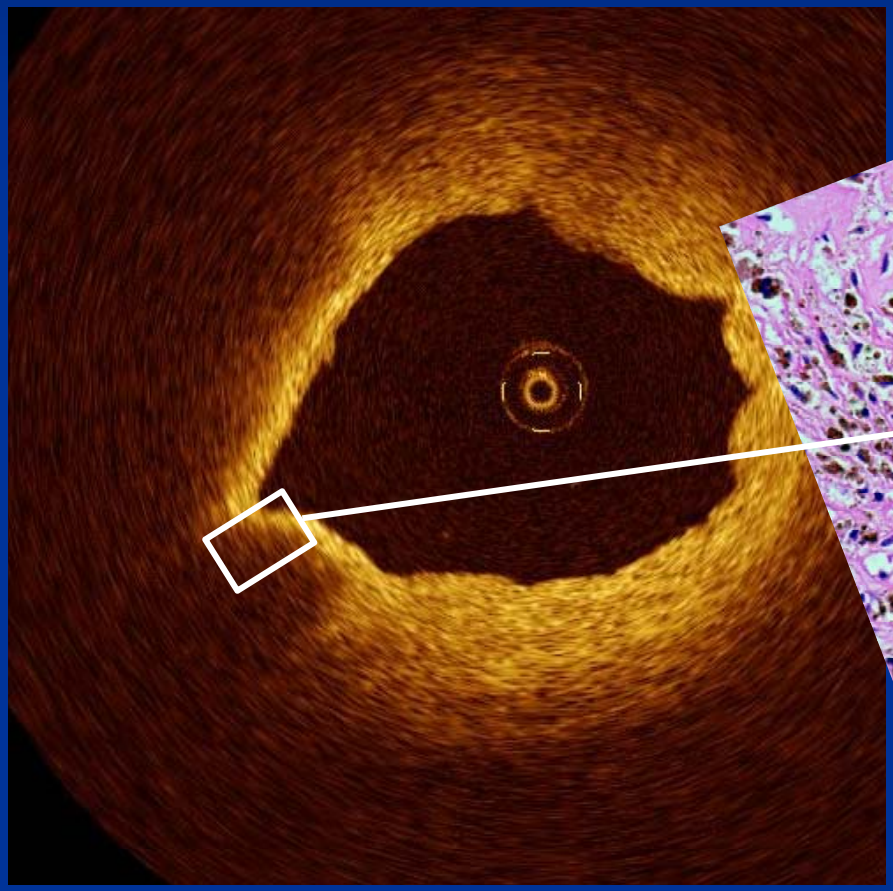
Histological image

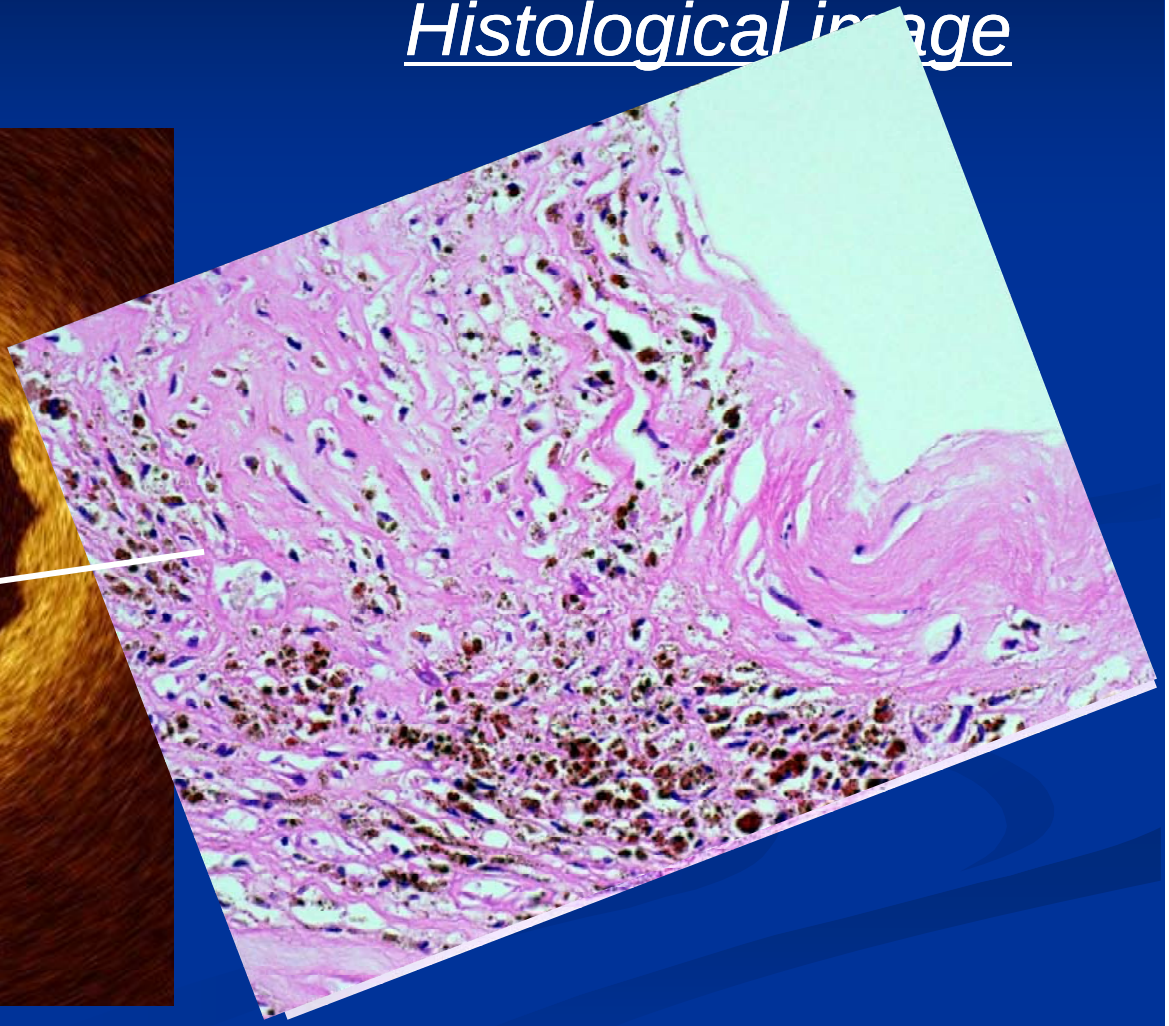


Case 3: non ACS

OCT image

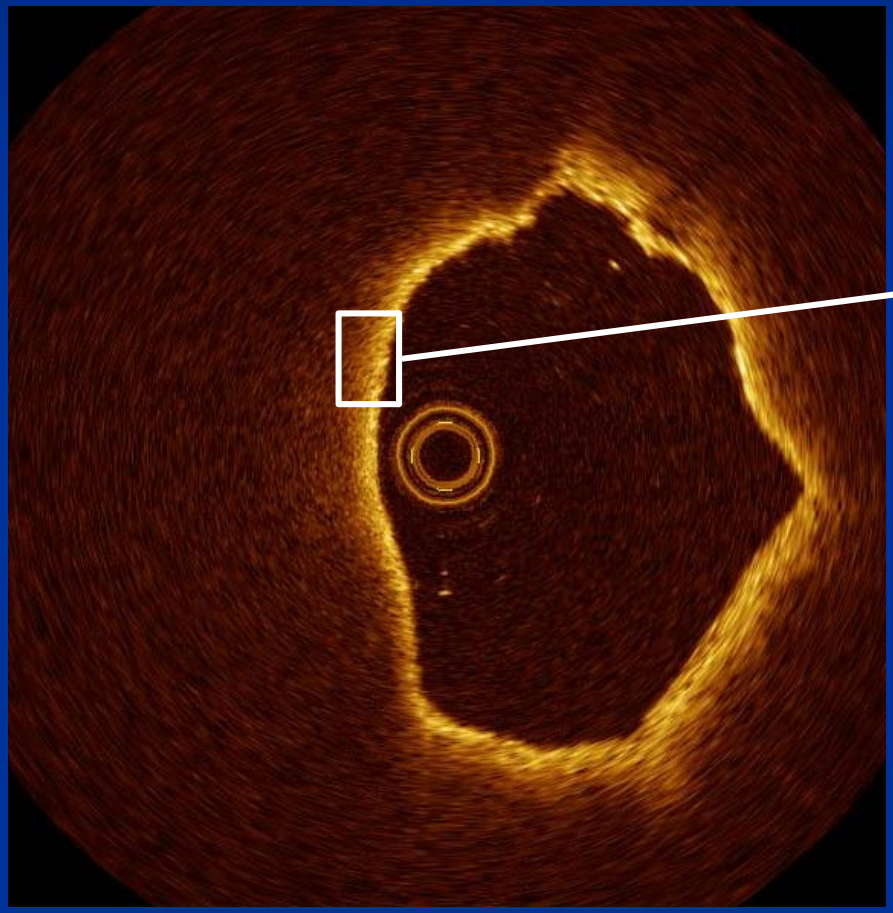
Histological image

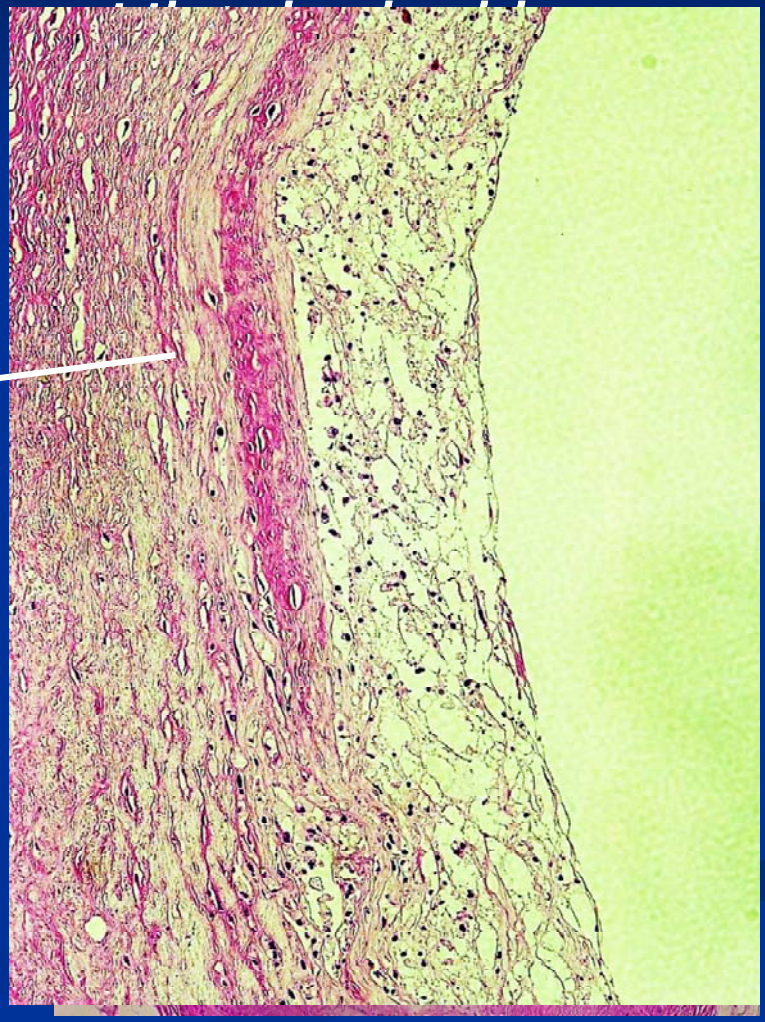




Case 4: non ACS

OCT image





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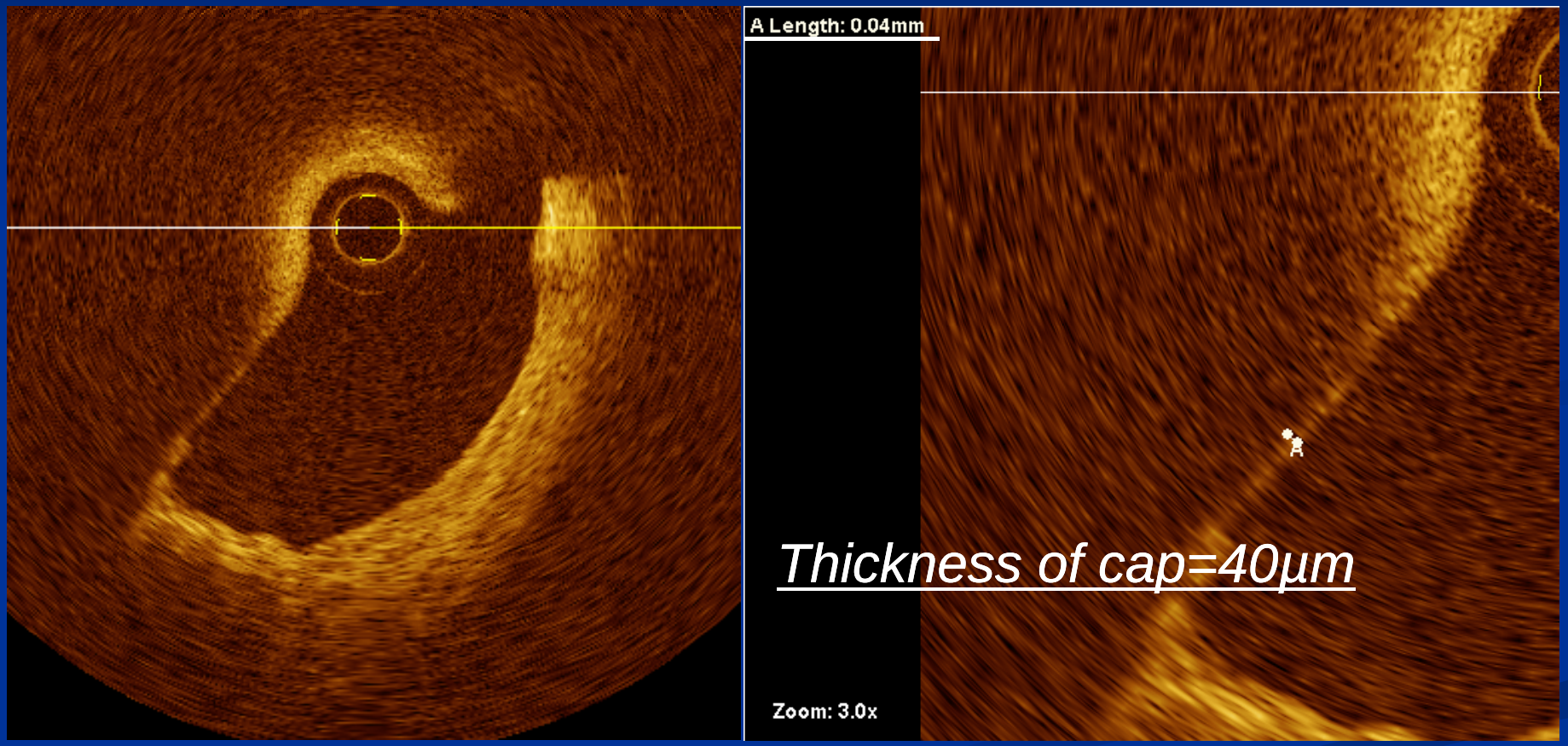
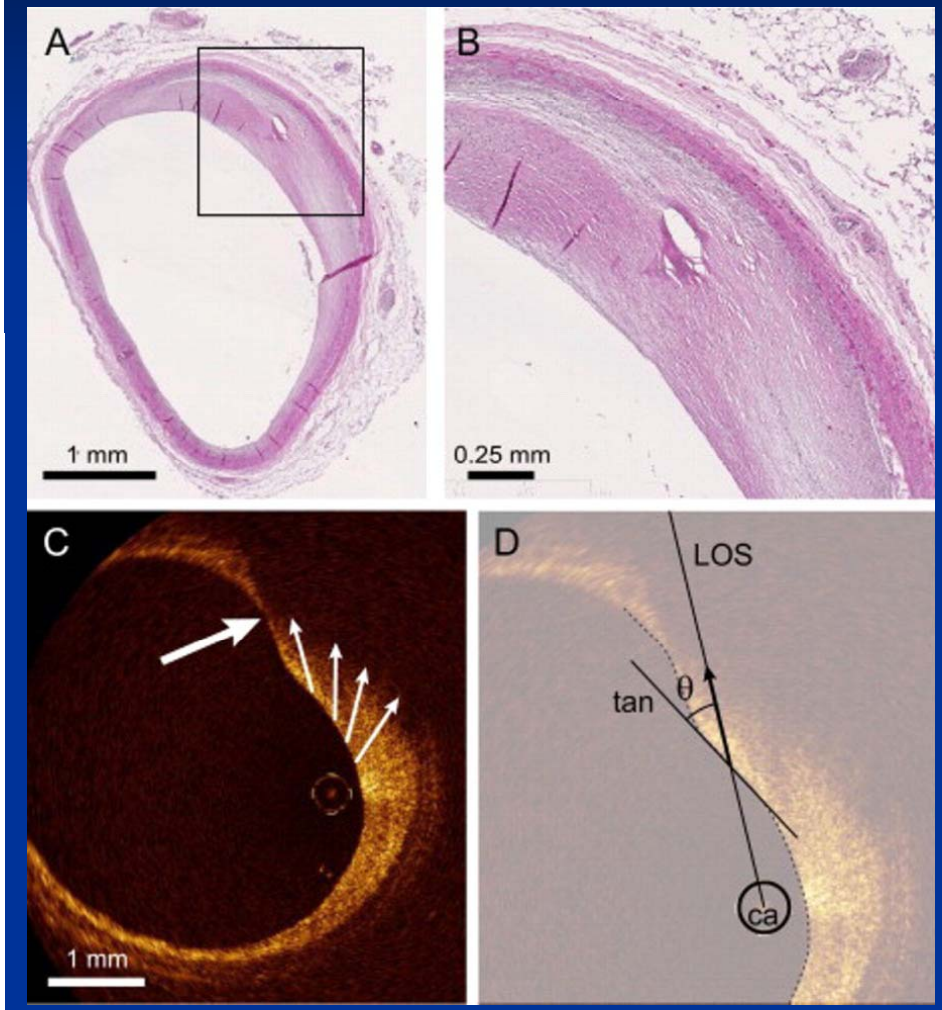
Large necrotic core?



Tangential signal drop

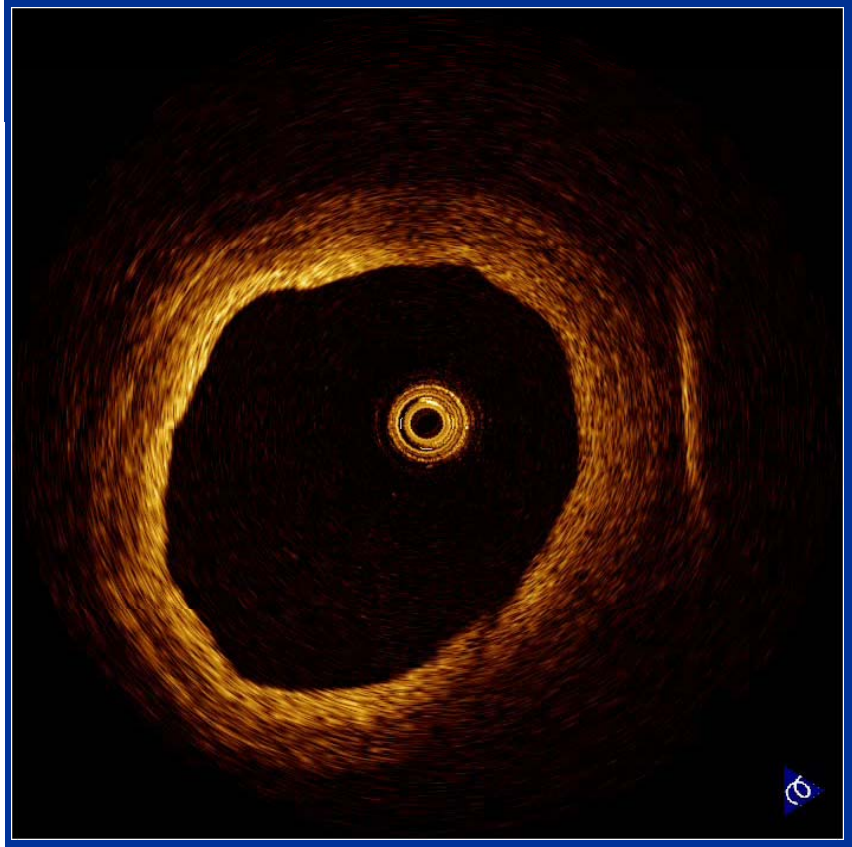


If the imaging beam strikes the tissue under a glancing angle, a low intensity area with diffuse borders, covered by a thin signal-rich layer, can arise, which appears like lipid-rich plaque covered by a fibrous cap.

van Soest G, et al. JACC Cardiovasc Imaging. 2011;4:810-3.

Tangential signal drop

grasping the specimen with tweezers



Take home messages

- ✓ OCT provides accurate tissue morphology *in vivo* (e.g. TCFA, thrombus, calcium).
- ✓ Coronary plaque is highly heterogeneous, especially in patient with stable angina.
- ✓ In addition to necrotic core (lipid core), OCT light is attenuated by several components.
- ✓ If the OCT beam strikes the vessel wall obliquely, the evaluation should be performed carefully.