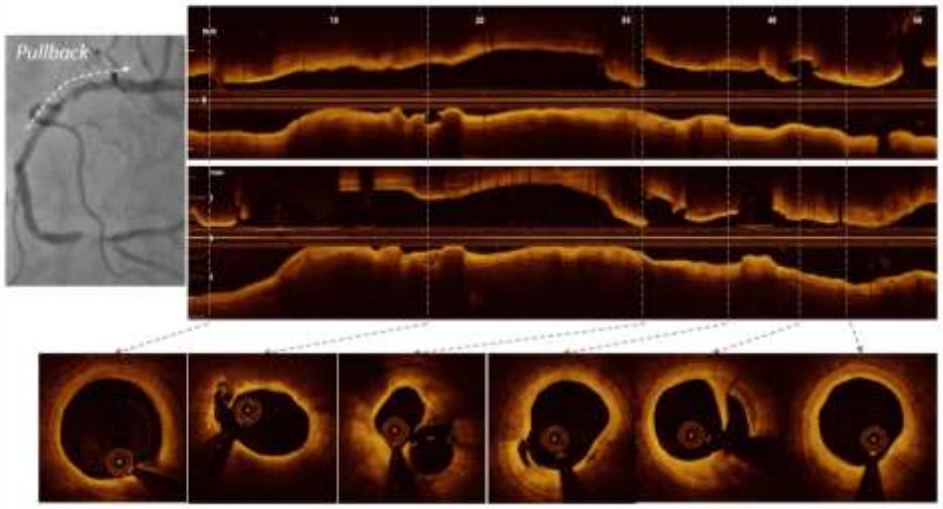
IMAGING BASED INVASIVE MANAGEMENT IN AMI, IS IT ALWAYS PRACTICAL?

Mohamed Loutfi, MD
Professor of Cardiology
Faculty of Medicine,
University of Alexandria

Imaging Based Invasive Management in AMI

STEMI: plaque morphologies/extension to guide PCI

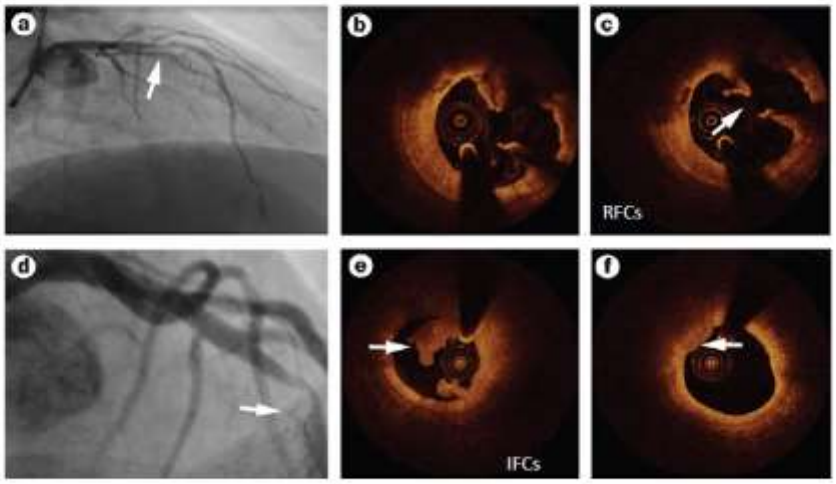


Imaging Based Invasive Management in AMI

PLAQUE MORPHOLOGY

STEMI

Pathologically Distinct Types of Culprit Lesions: RFC vs IFC



Otsuka F *et al.* Nature Reviews Cardiology, 2014, vol. 11

JACC: CARDIOVASCULAR IMAGING
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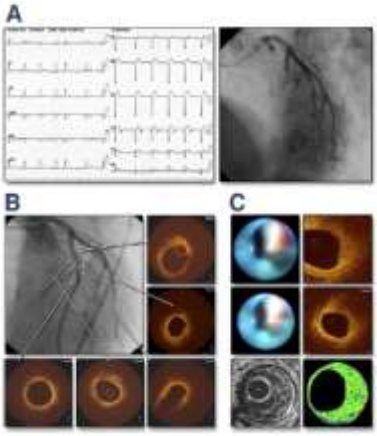
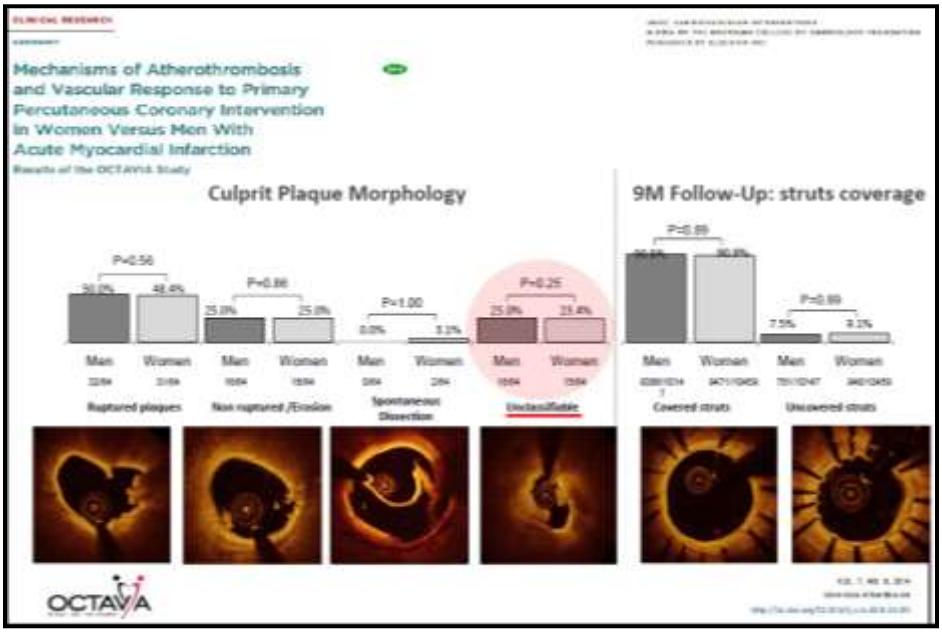
http://dx.doi.org/10.1016/j.jcmg.2012.12.007

OCT-Based Diagnosis and Management of STEMI Associated With Intact Fibrous Cap

Francesco Prati, MD, PhD,*† Shiro Uemura, MD, PhD,‡ Gerrad Souteyrand, MD, PhD,§

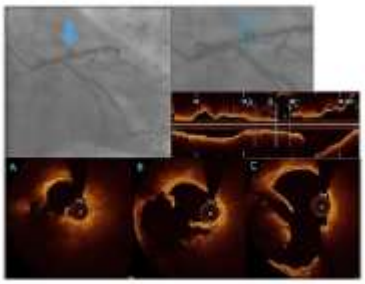


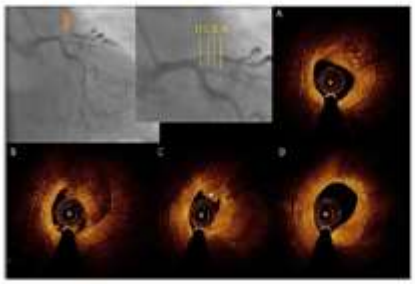


Plaque morphologies and the clinical prognosis of acute coronary syndrome caused by lesions with intact fibrous cap diagnosed by optical coherence tomography

Taishi Yonetsu [a,b,1], Tetsumin Lee [a,1], Tadashi Murai [b,c], Makoto Suzuki [a,d], Akihiko Matsumura [a,1],

318 culprit lesions. Plaque rupture vs Intact FC vs Massive Thrombus precluding visualization

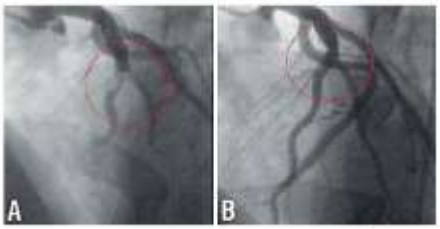




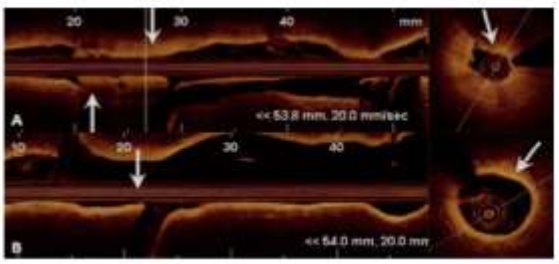
International Journal of Cardiology 203 (2016) 766–774

Safety of lone thrombus aspiration without concomitant coronary stenting in selected patients with acute myocardial infarction

Jesús Jiménez*, MD, PhD, Mauro Echavarría-Pinto, MD, Tamara Gonzalez, MD, Marcos Gonzalo, MD, PhD,



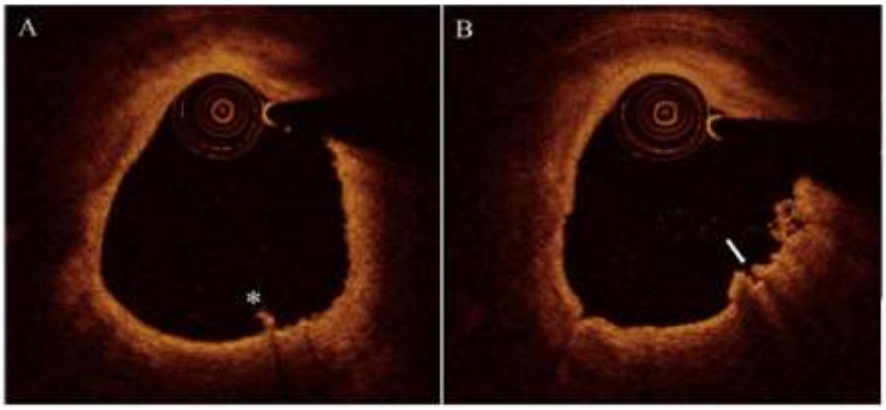
- Our results suggest that, **in selected patients undergoing P-PCI in whom an optimal results** (as assessed with angiography **or intracoronary imaging**) has been obtained with TA, additional stenting can be avoided, particularly when the potential benefit conferred by stenting might be **outweighed by anatomical or clinical characteristics**



CLINICAL RESEARCH

EuroIntervention 2013;8:1148-1156

Can Plaque Erosion be Identified by OCT?



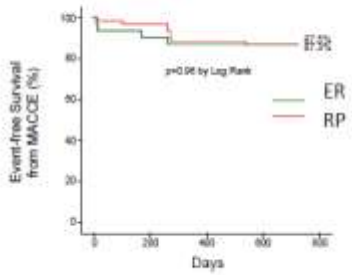
- .... but thrombus may obscure the underlying plaque morphology.

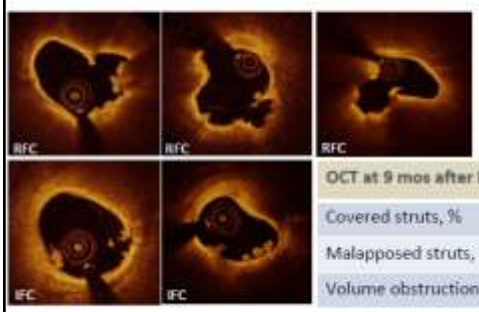
Fineschi M et al, J Cardiovasc Med 2013, 393-4

Eroded Versus Ruptured Plaques at the Culprit Site of STEMI

In Vivo Pathophysiological Features and Response to Primary PCI

ORIGINAL RESEARCH OCTAVIA





OCT at 9 mos after EES	Erosion (N=52)	Rupture (N=63)	P
Covered struts, %	93 [82-100]	91 [82-96]	0.152
Malapposed struts, %	0.3 [0.0-5]	0.6 [0.0-5]	0.880
Volume obstruction, %	13 [5-21]	10 [6-15]	0.265

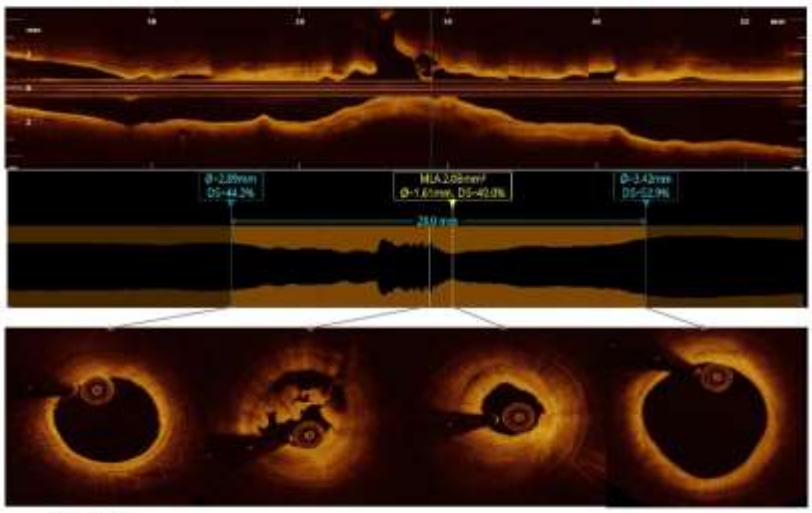
Imaging Based Invasive Management in AMI

Imaging……

Extension to guide PCI

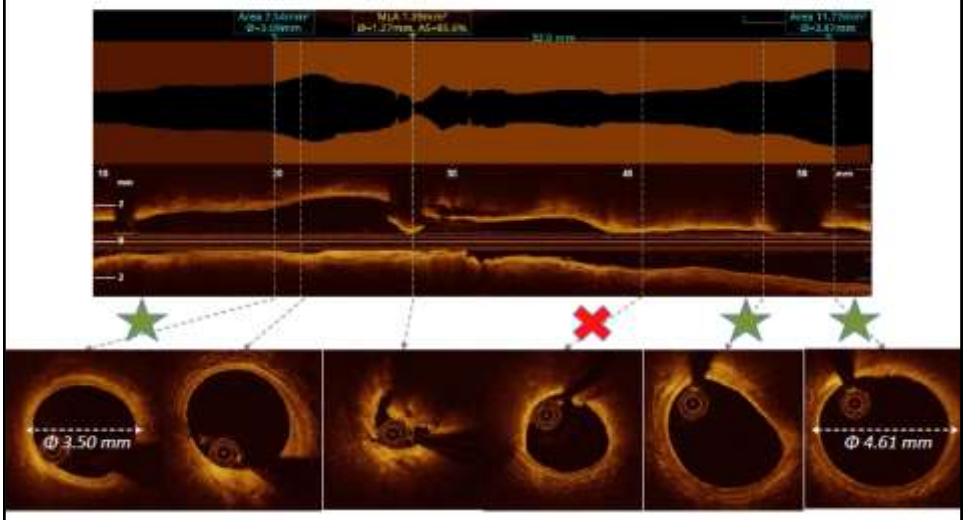
Measurements more than interpretation

STEMI culprit vessel: 75 mm in 2 sec, automatic lumen measures



Lesion Length

Not only lesion severity: decision making on landing zone for stenting

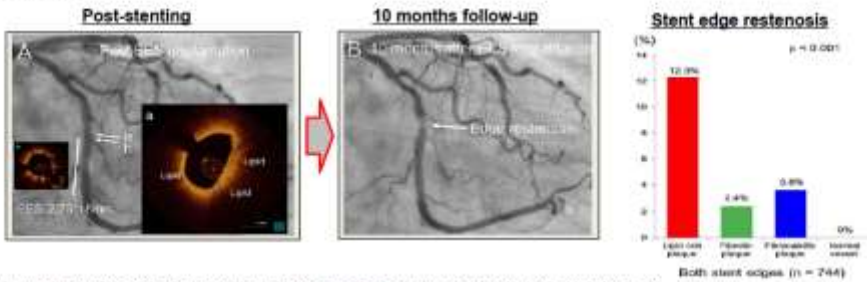


Landing zone for stenting

OCT Predictors for Edge Restenosis after EES

744 stent (EES) edge segments in 319 patients

OCT used to evaluate morphological characteristics of the coronary plaques that developed DES edge restenosis.



(A) Immediately after EES implantation, OCT images showed lipid rich plaque at the proximal stent edge (a, b).
(B) At 10-month follow-up, angiography demonstrated stent edge restenosis at the proximal edge of the stent.

Implication for patient care: Lipidic plaque and minimum lumen area in the stent edge segments at post-stenting are predictors of late stent failure.

Y Ino et al. Circulation Cardiovasc Interv 2016, in press

Landing zone for stenting

International journal of Cardiology

Co-registration of optical coherence tomography and X-ray angiography in percutaneous coronary intervention. The Does Optical Coherence Tomography Optimize Revascularization (DOCTOR) fusion study☆

Lasse Helmgaard [a], Troels Munck Nielsen [a], Shengxian Tu [b], Lars Romer Krusell [a], Michael Maeng [a],

Operator Registration Error
The error predicting the Landing Zone on XA after marking it on OCT

5.4 ± 3.5 mm

Geographic Miss Distance
The mismatch of the co-registration based I.2, and the actual stent position

5.4 ± 2.6 mm*

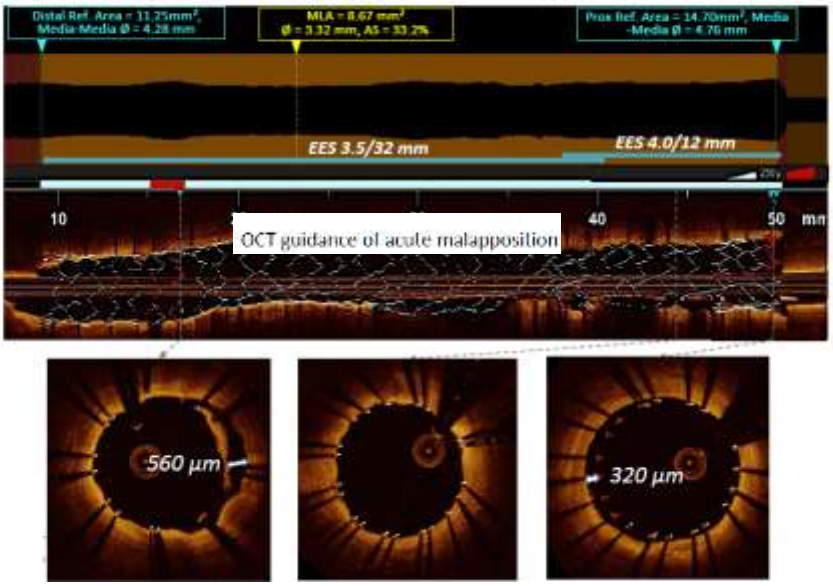
* Actual implanted stent length 22. 4 ± 5.4 mm

Implication for patient care: without access to the co-registered data, segments of the target lesion indicated on OCT were left uncovered by stent in 70% of cases

Landing zone for stenting

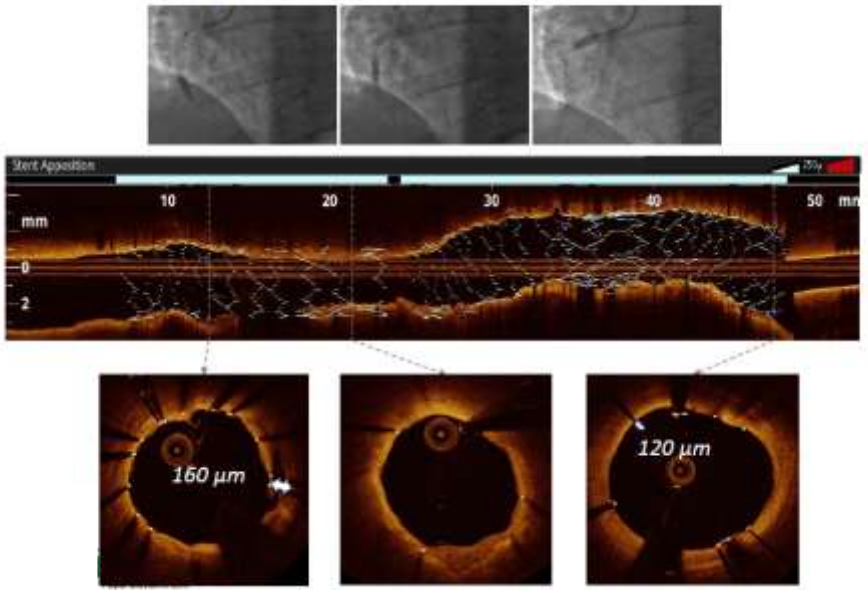
Automatic stent rendering and malapposition detection

white dot = apposed strut, red dot = malapposed strut



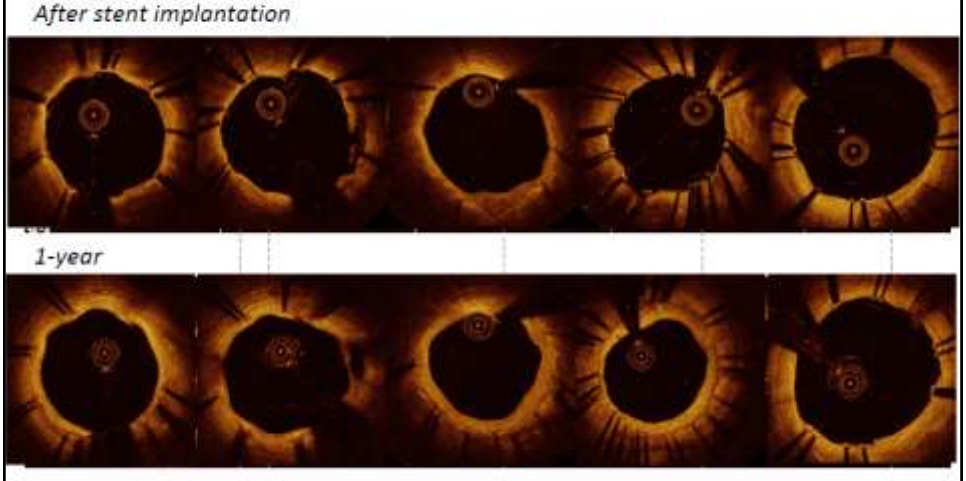
Optimization of PCI result

Additional postdil: 4.0mm HP mid-distal, 4.5 mm HP prox edge



Optimization of PCI result

Vascular response at 1-year

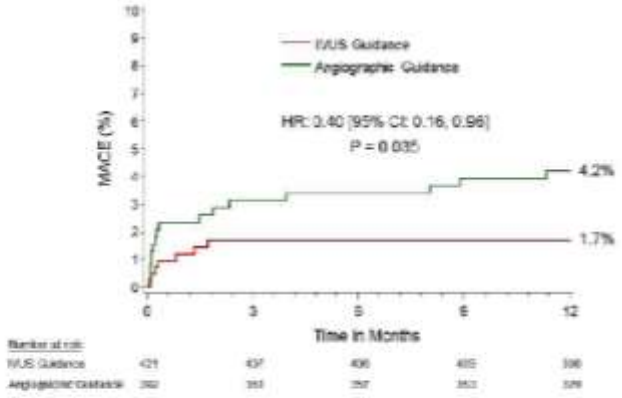


Optimization of PCI result

Relationship Between Intravascular Ultrasound Guidance and Clinical Outcomes After Drug-Eluting Stents

The Assessment of Dual Antiplatelet Therapy With Drug-Eluting Stents (ADAPT-DES) Study

813 STEMI



Circulation 2014; 129: 463-470, suppl. material

Optimization of PCI result .. Better outcome

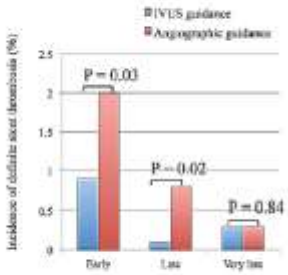
ORIGINAL ARTICLE
Ischemic Heart Disease

(Circ J 2016; 80: 477–484)

Intravascular Ultrasound Guidance vs. Angiographic Guidance in Primary Percutaneous Coronary Intervention for ST-Segment Elevation Myocardial Infarction

– Long-Term Clinical Outcomes From the CREDO-Kyoto AMI Registry –

Kenji Nakamura, MD; Hiroki Shiomi, MD; Takeshi Morimoto, MD; Kenji Ando, MD;



3028 STEMI: 932 IVUS guidance vs 2096 angio guidance

	IVUS guidance					
	Unadjusted			Adjusted		
	HR	95% CI	P	HR	95%	P
Definite ST	**0.39**	**0.20-0.71**	**0.003**	0.58	0.19-1.72	0.33
MACE	**0.83**	**0.73-0.94**	**0.003**	1.12	0.89-1.40	0.33

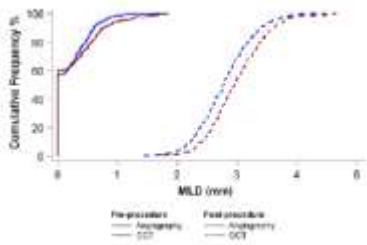
- No data collected on the timing of IVUS (**either before or after intervention or both**) and/or IVUS parameters
- No specific guidelines for optimal stenting

Coronary Physiologic Assessment and Imaging

Optical Coherence Tomography–Guided Percutaneous Coronary Intervention in ST-Segment–Elevation Myocardial Infarction

A Prospective Propensity–Matched Cohort of the Thrombectomy Versus Percutaneous Coronary Intervention Alone Trial

Tej N. Sheth, MD; Olli A. Kajander, MD, PhD; Shahar Lavi, MD

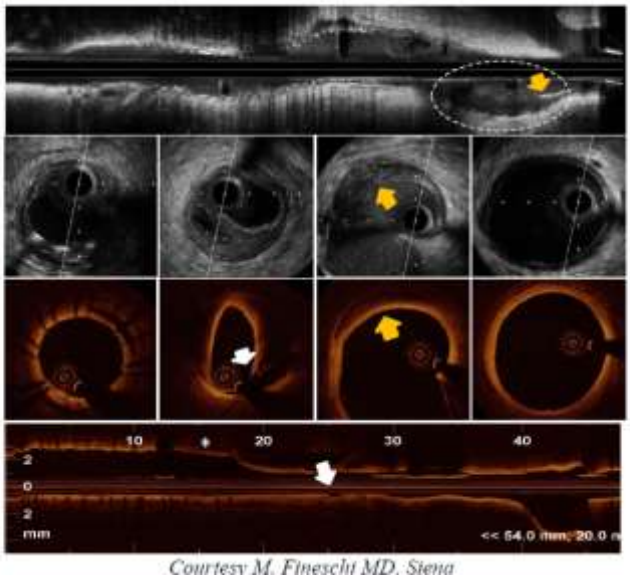


10.732 patients enrolled in the TOTAL Trial

	OCT (n=214)	Angio (n=428)		P
Post-procedure				
MLD, mm*	2.99±0.48	2.79±0.47		<0.0001
PCI procedure time, min	58 (47, 71)	38 (28, 52)		<0.0001
Contrast media volume, m	239.7±81.1	193.3±78.6		<0.0001
			Hazard Ratio (95% CI)	
MACE 1 yr FU	16 (7.5%)	42 (9.8%)	0.76 (0.43-1.34)	0.34

Circ Cardiovasc Interv. 2016;9:e003414. DOI: 10.1161/CIRCINTERVENTIONS.115.003414.

UNCLEAR CASES OF STEMI: DIAGNOSIS WITH OCT/IVUS

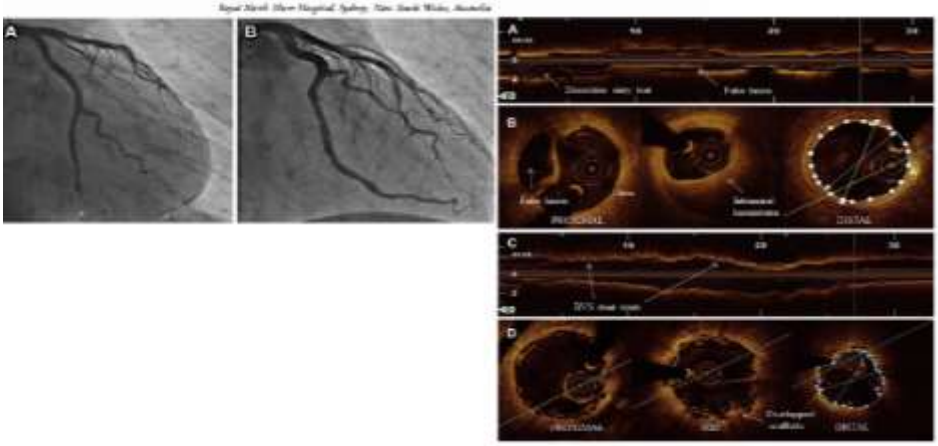


Courtesy M. Fineschi MD. Siena

Case Report

Spontaneous Coronary Artery Dissection Treated With Bioresorbable Vascular Scaffolds Guided by Optical Coherence Tomography

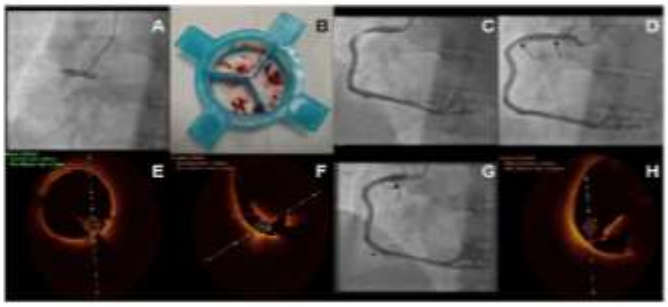
James Cockburn, MD, BSc, MRCP, Warren Yan, FRACP, Ravinay Bhindi, PhD, FRACP, and Peter Hansen, PhD, FRACP



IMAGES IN INTERVENTION

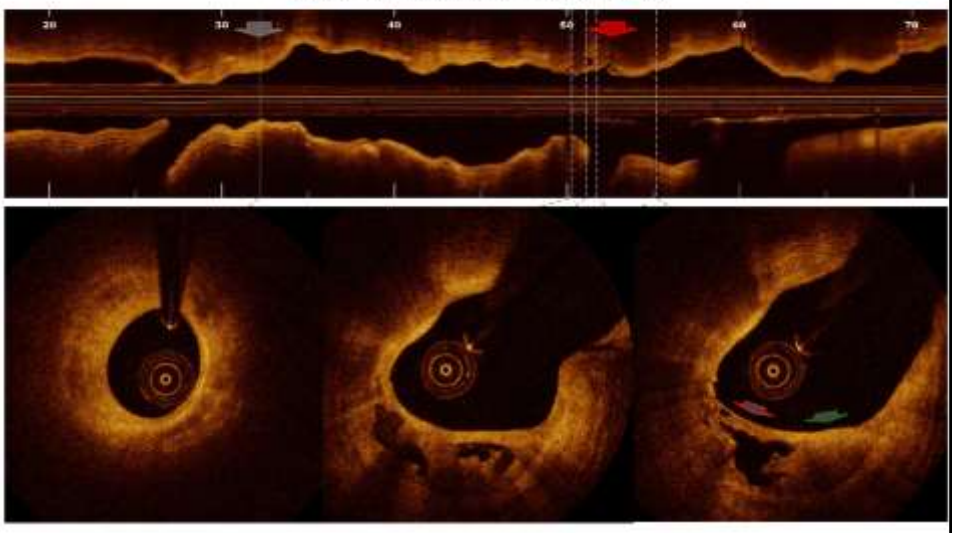
Cocaine-Induced Coronary Vasospasm Using Optical Coherence Tomography Imaging to Guide Management

Matthew W.P. Jackson, MRCS, Paul D. Williams, BM, CelS, MA, MD



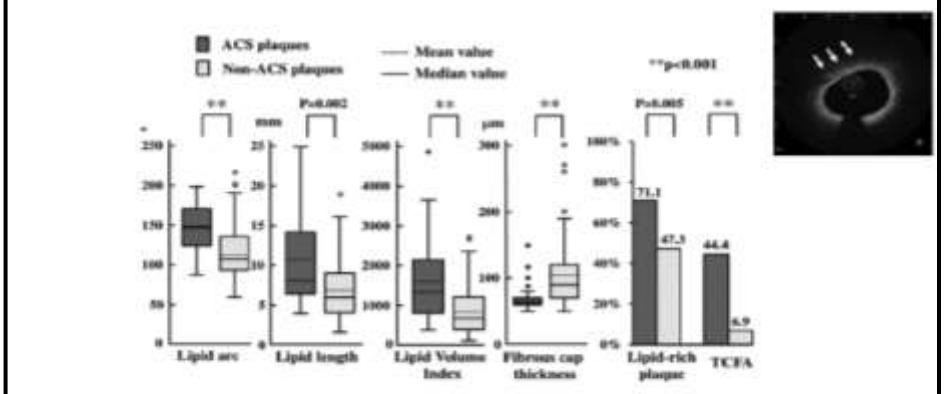
Unmet Needs: Non Culprit plaque identification and treatment

severe stenosis vs plaque vulnerability



identification of high-risk non-culprit lesion

Nonculprit Plaques in Patients With ACS Have More Vulnerable Features Compared With Those With Non–ACS



Kato k. et al Circ Cardiovasc Imaging 2012; 5(4):433-440

identification of high-risk non-culprit lesion

ACC.16

Plaque Characterization informs the risk of Periprocedural MI During PCI

The COLOR Registry

	Peri-MI	No Peri-MI	P
MLA (mm^2)	2.5(2.0, 2.9)	2.5(1.9,3.4)	0.86
Lesion length (mm)	23.1(18.0,34.0)	24.0(17.9,29.8)	0.87
Plaque burden at MLA (%)	72.5(67.7, 79.2)	78.3(69.4, 84.2)	0.21
MaxLCBI4mm>200 with superficial attenuated plaque	50%	20%	0.005
MaxLCBI4mm	401(162, 678)	276(84, 646)	0.008

Zhang W et al. JACC 2016, 67(13): 378

identification of high-risk non-culprit lesion

EDITORIAL COMMENT

Do We Know What Causes Very Late Drug-Eluting Stent Thrombosis?*

Gary S. Mintz, MD, Akiko Maehara, MD

New York, New York

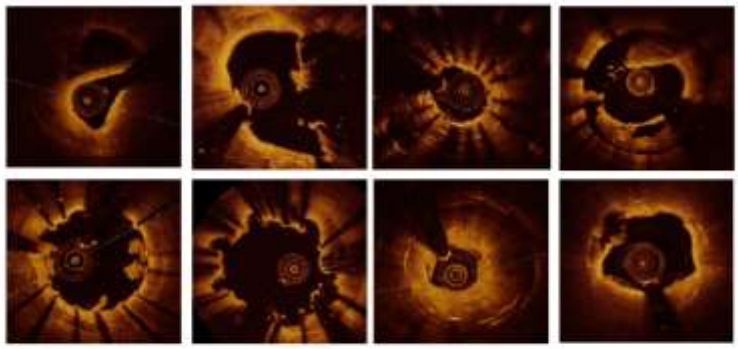
Recommendations for the clinical value of intracoronary diagnostic techniques

Recommendations	Class	Level	Ref
FFR to identify haemodynamically relevant coronary lesion(s) in stable patients when evidence of ischaemia is not available.	I	A	50,51,713
FFR-guided PCI in patients with multivessel disease.	IIa	B	54
IVUS in selected patients to optimize stent implantation.	IIa	B	702,703,706
IVUS to assess severity and optimize treatment of unprotected left main lesions.	IIa	B	705
IVUS or OCT to assess mechanisms of stent failure.	IIa	C	
OCT in selected patients to optimize stent implantation.	IIb	C	

PRESTIGE REGISTRY – 217 Stent Thrombosis

158 (73.8%) presented with STEMI

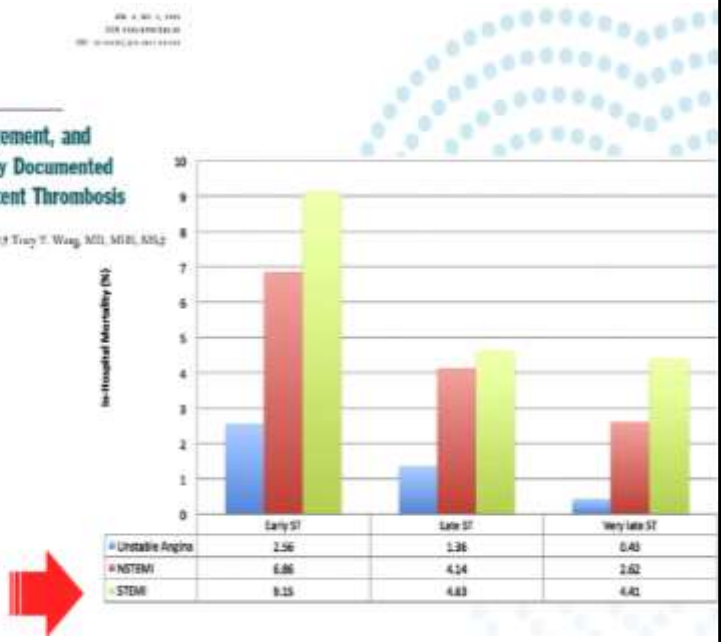
ClinicalTrials.gov NCT01300507



G. Guagliumi et al TCT 2016 Featured Presentation

CLINICAL RESEARCH

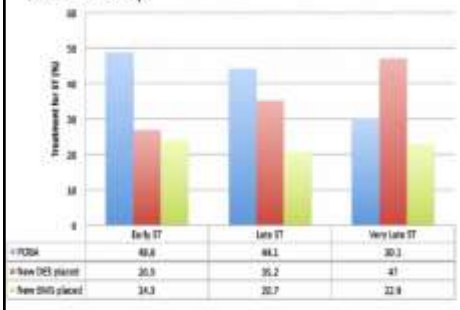
Clinical Presentation, Management, and Outcomes of Angiographically Documented Early, Late, and Very Late Stent Thrombosis



	Early ST	Late ST	Very late ST
Unstable Angina	2.56	1.36	0.43
NSTEMI	6.86	4.14	2.62
STEMI	9.15	4.63	4.41

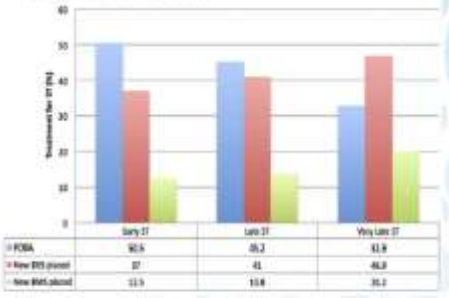
Treatment in all Stent Thrombosis and in DES ST.

A Overall Group



	Early ST	Late ST	Very Late ST
PCBA	48.8	44.1	30.1
New DES placed	20.9	35.2	47
New BMS placed	34.3	20.7	22.9

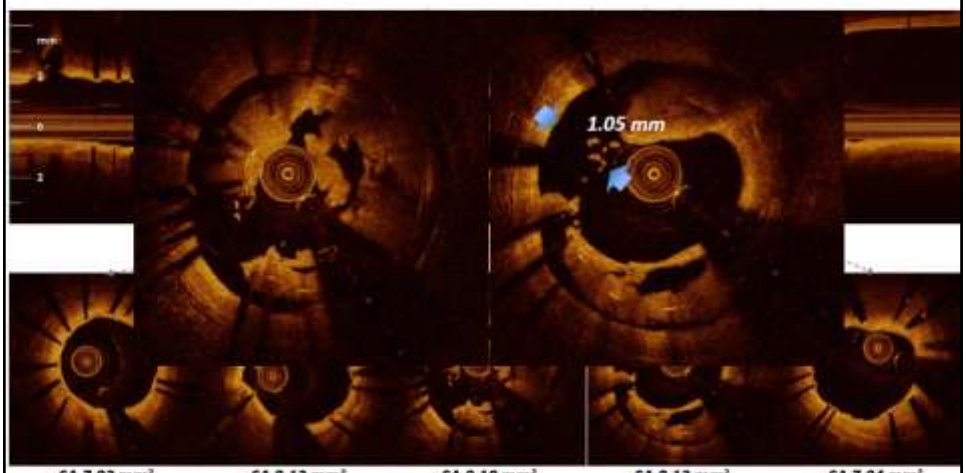
B Stent Thrombosis of a DES



	Early ST	Late ST	Very Late ST
PCBA	50.6	35.2	32.8
New DES placed	37	41	46.9
New BMS placed	12.5	13.8	20.3

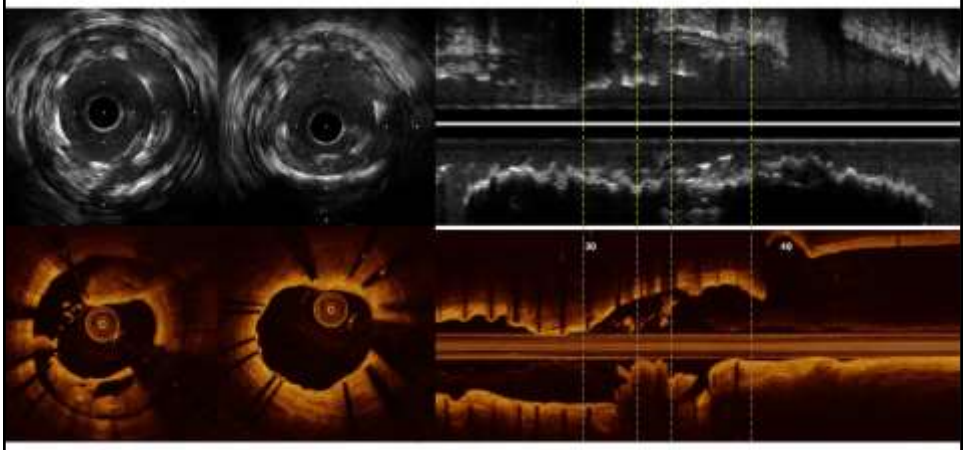
Armstrong EJ et al JACC Cardiovasc Interv 2012, 5(2):131-40

Large segmental malapposition with uncovered struts

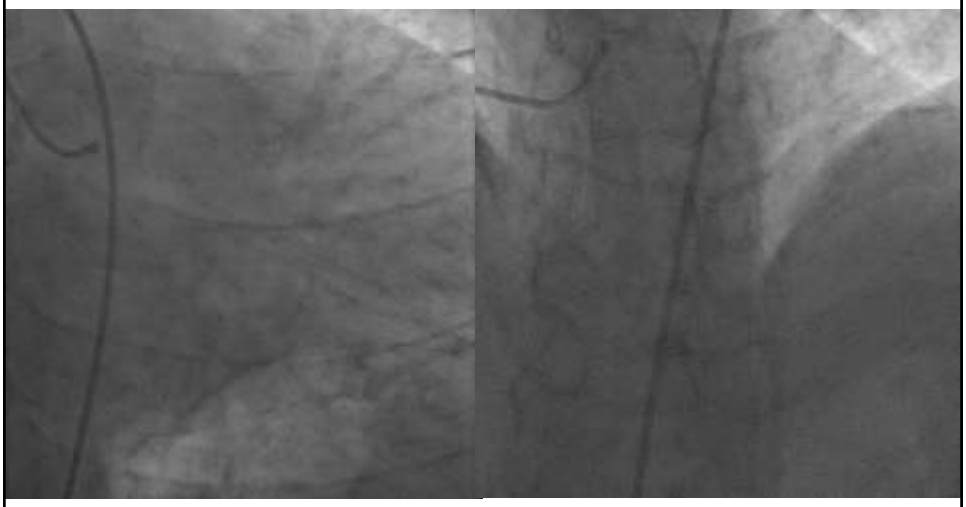


SA 7.02 mm² | SA 8.12 mm² | SA 9.10 mm² LA 16.47 mm² | SA 8.12 mm² LA 14.08 mm² | SA 7.94 mm²

Sister images: IVUS vs OCT



Male 34 yrs, DM , inferior STEMI

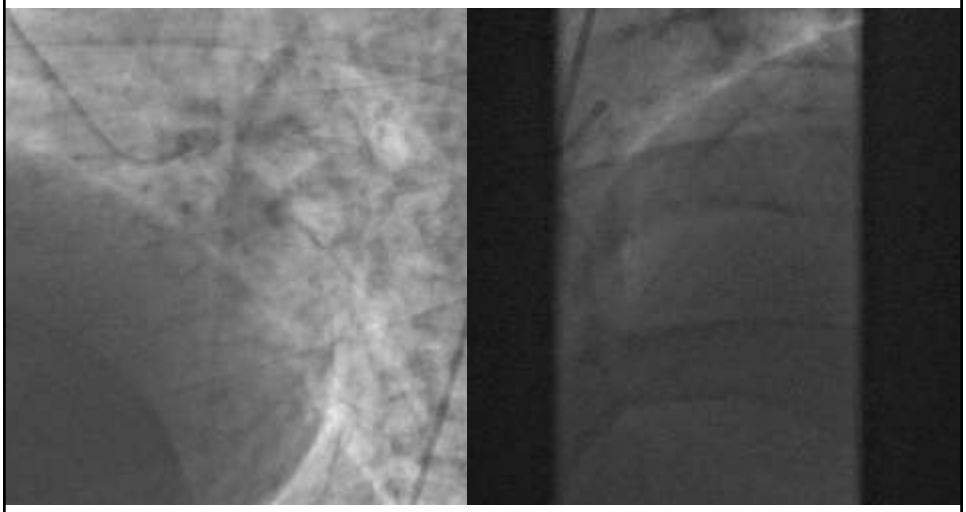


Male 34 yrs, DM , inferior STEMI

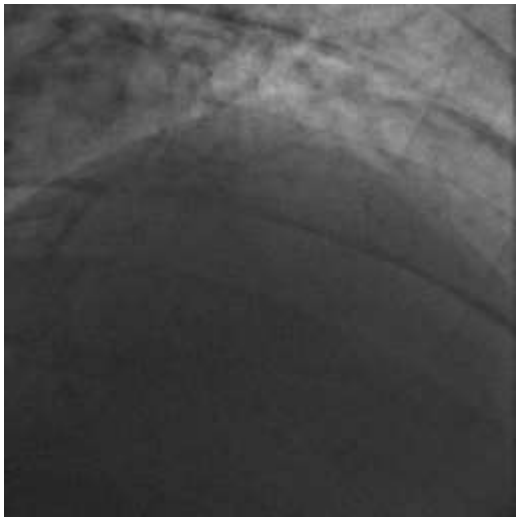
Male 34 yrs, DM , inferior STEMI

Male 34 yrs, DM , inferior STEMI

3 hrs later severe chest pain, raising in V3-V6 (dynamic ECG changes)



Male 34 yrs, DM , inferior STEMI



Imaging Based Invasive Management in AMI

- IC imaging can identify in vivo, with high level of accuracy, the culprit lesion phenotype underlying STEMI.
- However, limitations remain in alternative management of ER as 1) thrombus may preclude the visualization (≈25% of the cases) and 2) a reassuring vascular response to PCI with DES has been observed independently by the lesion
- Automatic lumen measures at pre and post stent implantation obtained with IC imaging may achieve a large post-procedure MLD, but the impact on MACE remains to be proven.

Imaging Based Invasive Management in AMI

- Detection of large lipid core at culprit site, landing zone for stenting and NC TCFA might be relevant to guide the procedure
- No data are available on strategy modification guided by imaging in STEMI with MVD
- Stent thrombosis has clear potentials for imaging treatment guidance