

Detecting Lipid Rich Plaques in Non-Culprit Lesions; Clinical Significance in Daily Practice

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Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

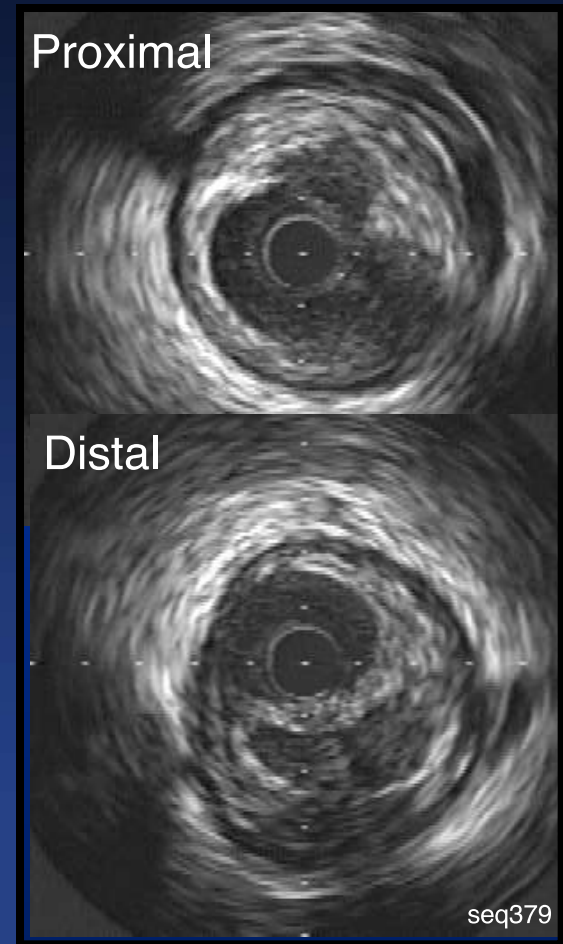
Affiliation/Financial Relationship	Company
■ Grant/Research Support	None
■ Consulting Fees/Honoraria	Volcano
■ Major Stock Shareholder/Equity	Technology Solutions Group
■ Royalty Income	None
■ Ownership/Founder	Technology Solutions Group, BioInfo Accelerator Fund
■ Intellectual Property Rights	None
■ Other Financial Benefit	None

Vulnerable patient; 1993

39 year old with Inferior MI. Non-culprit LAD imaged with multiple ruptured plaques



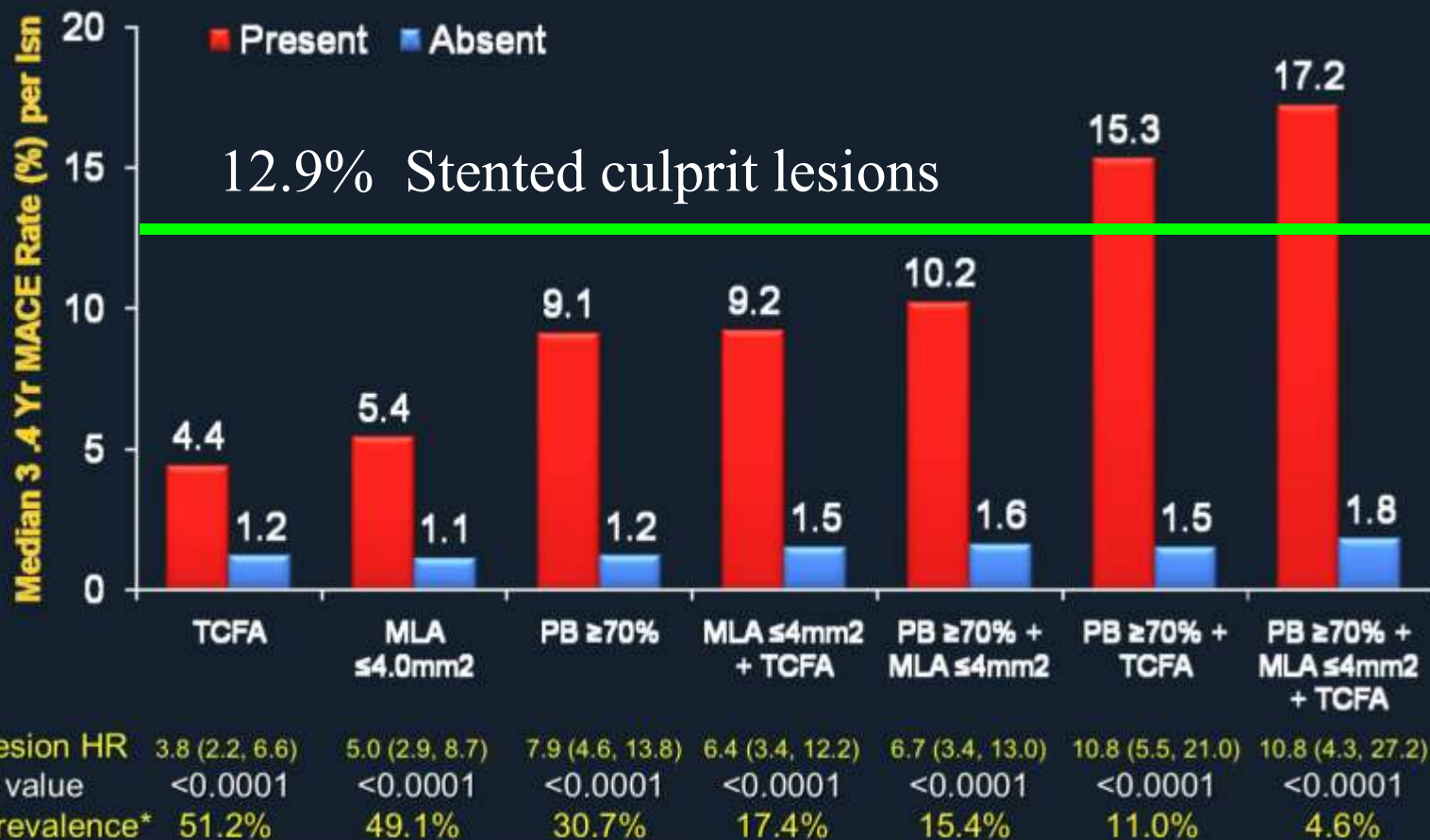
Can we predict this? Can we treat this?



Courtesy: Fitzgerald

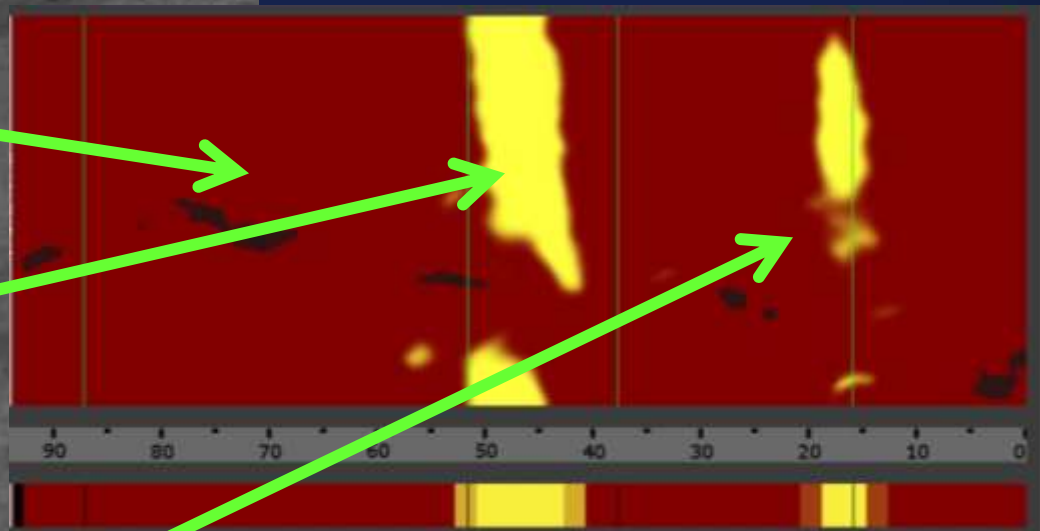
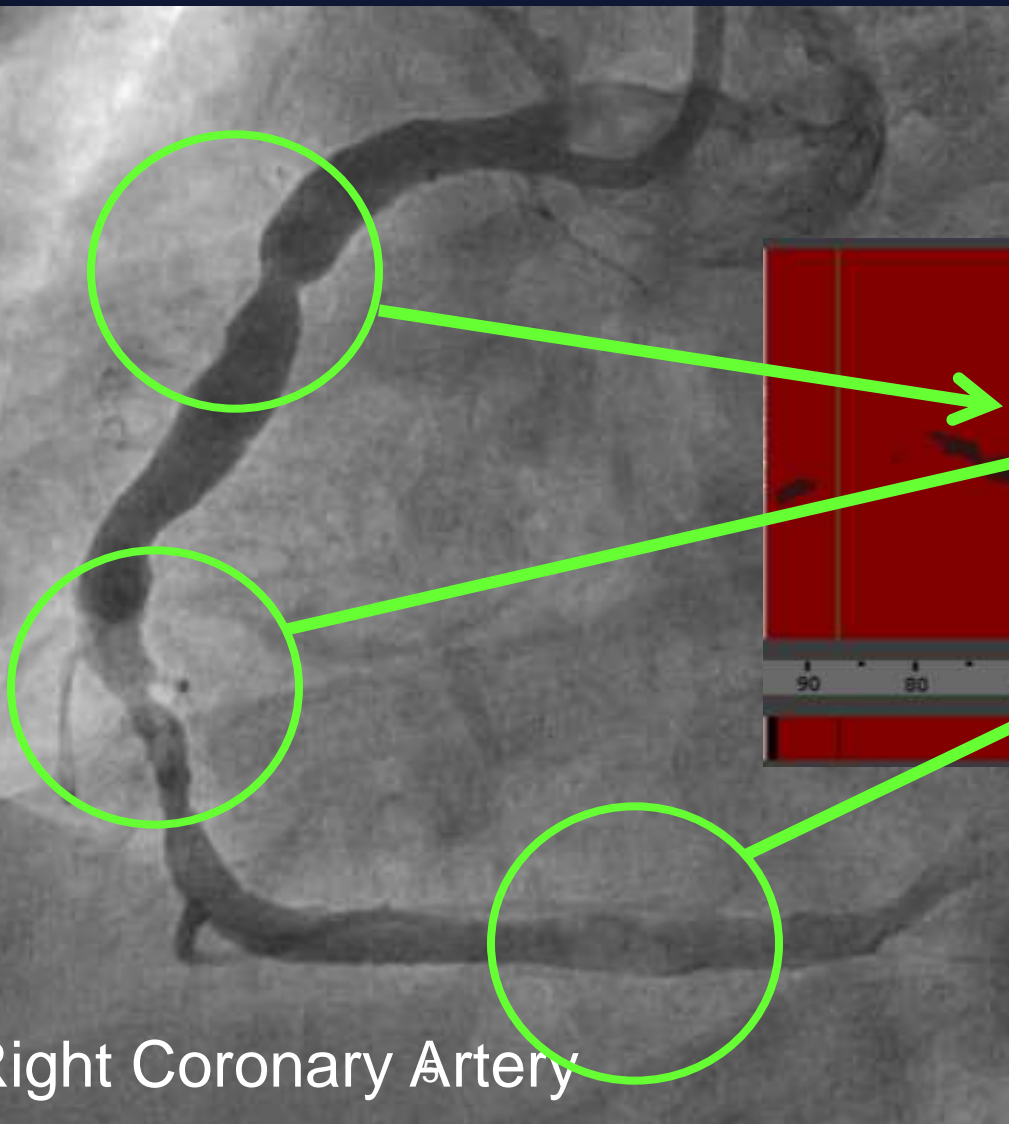
Natural history of lesions

PROSPECT: Correlates of Non Culprit Lesion Related Events



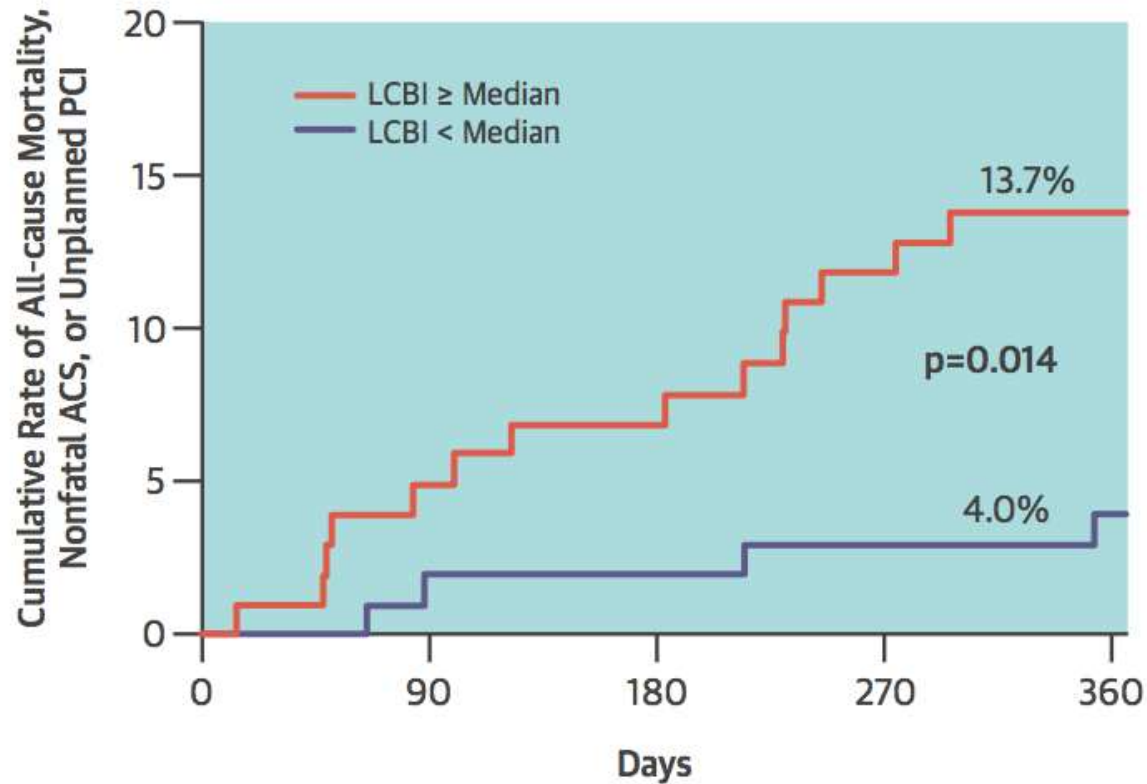
*Likelihood of one or more such lesions being identified per patient. PB = plaque burden at the MLA

NIR IVUS identifies lipid core plaque



Courtesy Dr. Simon Dixon
Beaumont Hospital,
Royal Oak, MI

ATHEROREMO-NIRS: MACE at 1 year

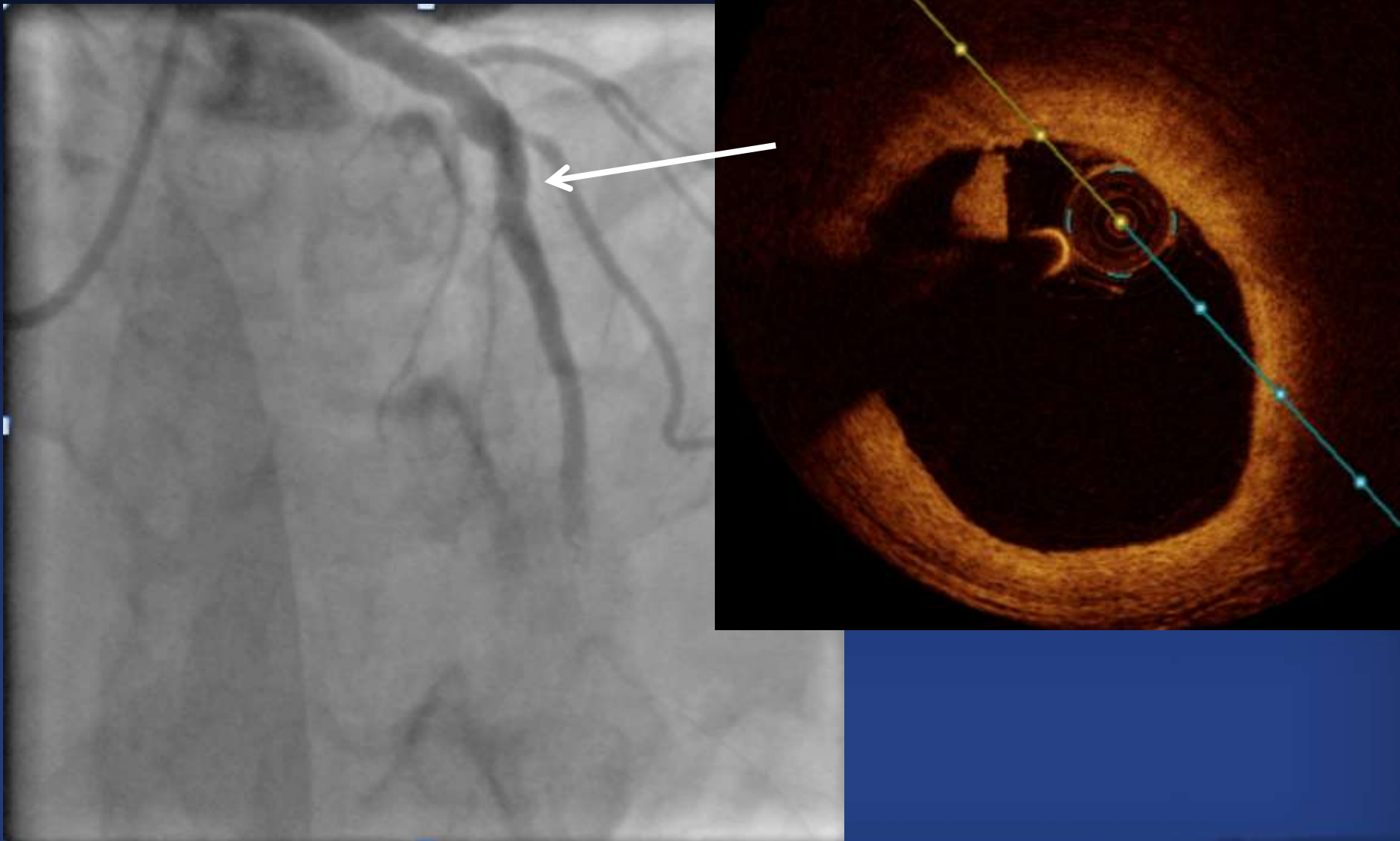


No. at Risk

LCBI < Median	101	99	99	97	91
LCBI ≥ Median	102	96	94	89	86

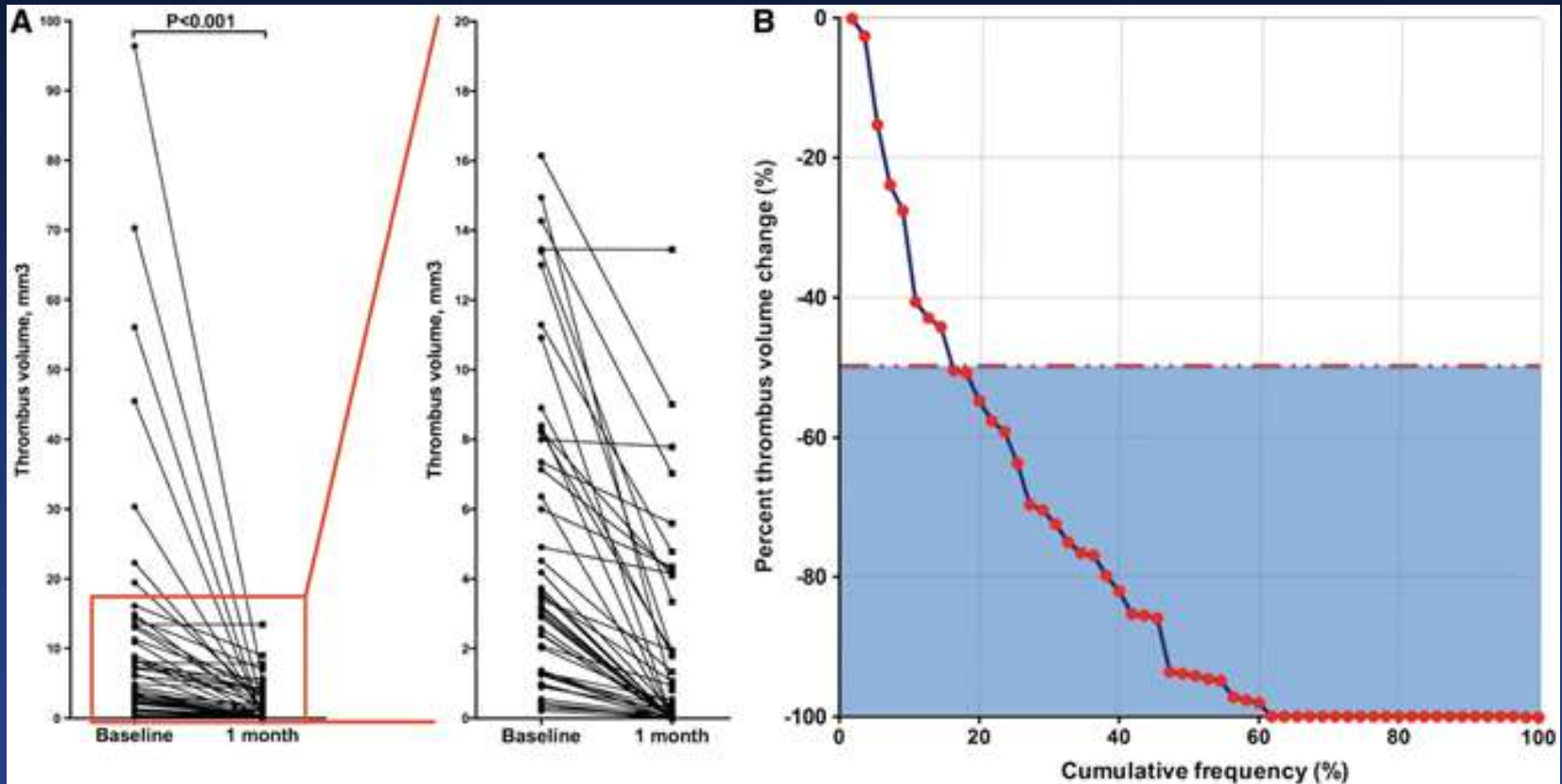
J Am Coll Cardiol 2014;64:2510–8

STEMI: Thrombus due to erosion



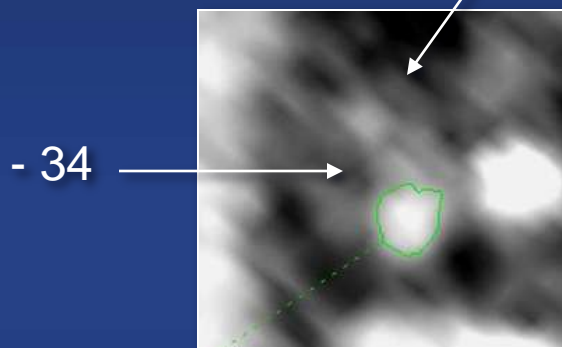
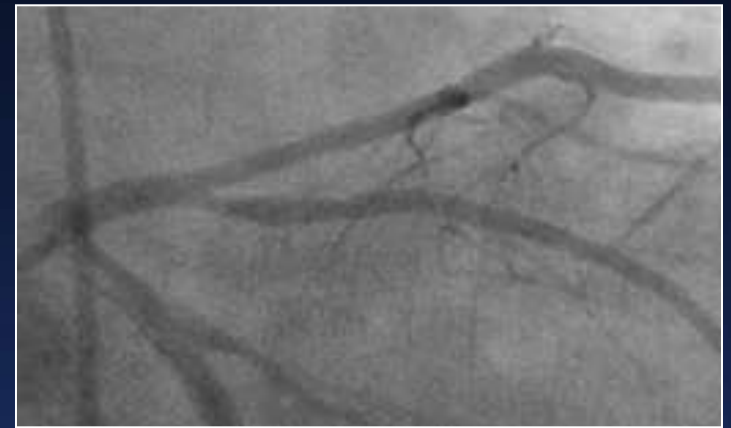
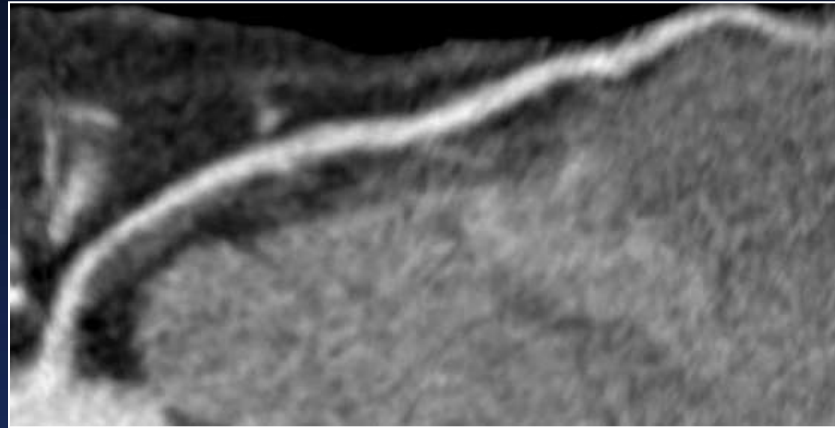
EROSION: safe Tx without stent placement

Thrombus resolution over 30 days, no events



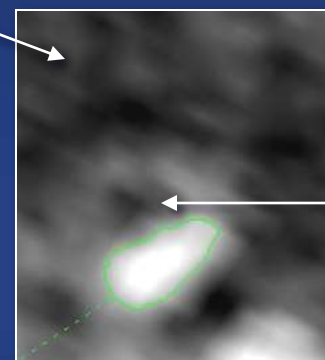
Eur Heart J 2017;38:792

Cardiac CTA



- 34

MLA 2.8 mm²



- 105

5.2 mm²

TCFA ?

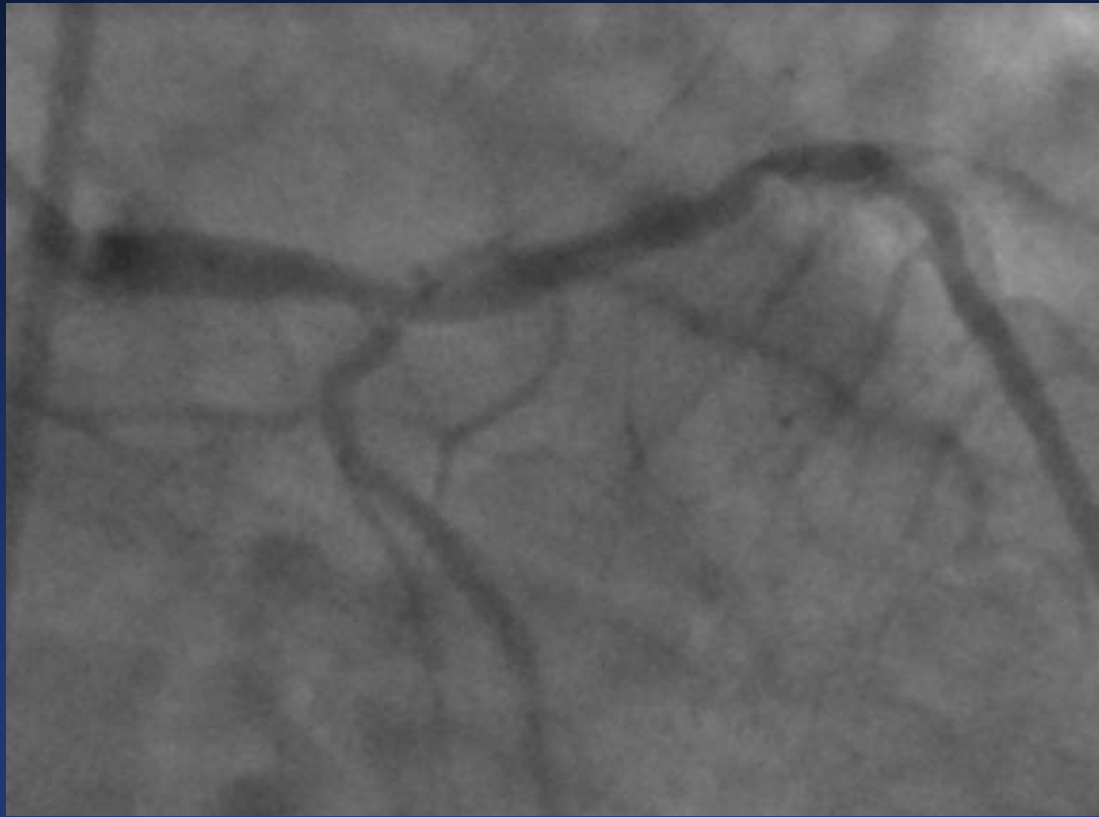
Courtesy: Harvey Hecht

Prevalence of vulnerable plaque at cath

- VH IVUS (NC lesions in ACS): 22%-30%
 - IB IVUS (ACS): 33%
 - NIRS: 57%
 - OCT: 19%
 - Grey scale IVUS (AMI): 79%
-
- Thus, an optimistic evaluation of the chances for finding a VP at routine cath is 30%

Acute coronary syndrome

Pre: LM and mid LAD lesions



Post stent to LM and mid LAD

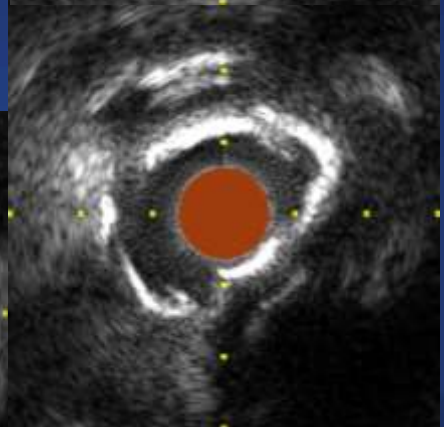
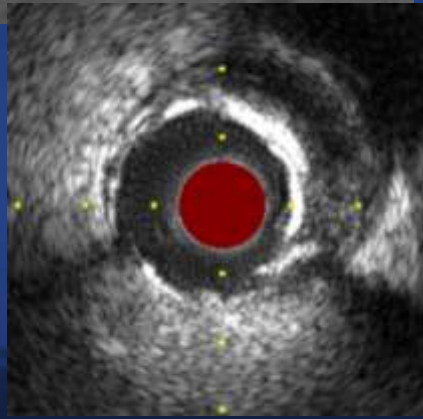
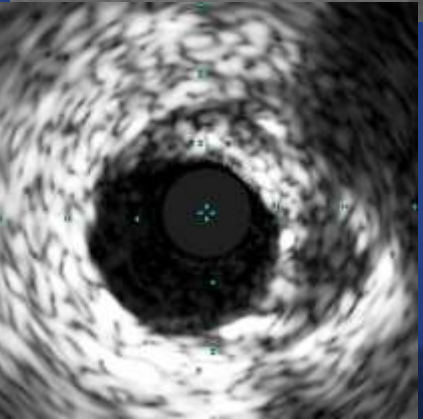
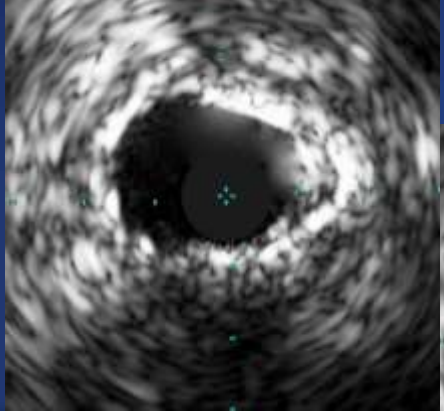
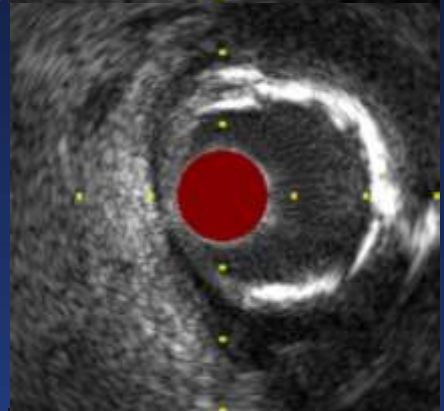
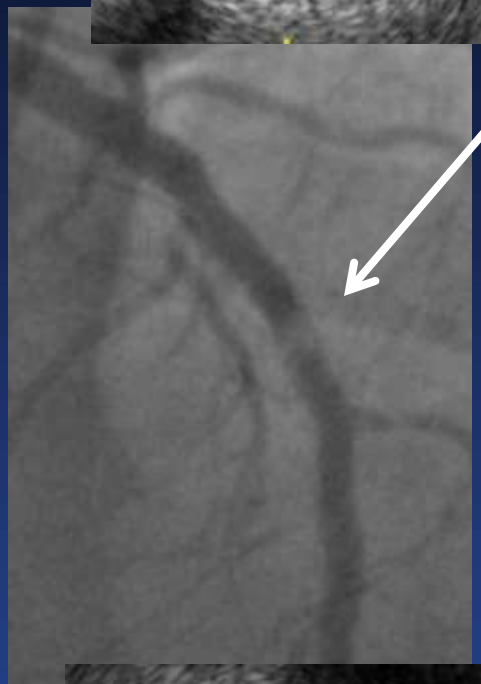
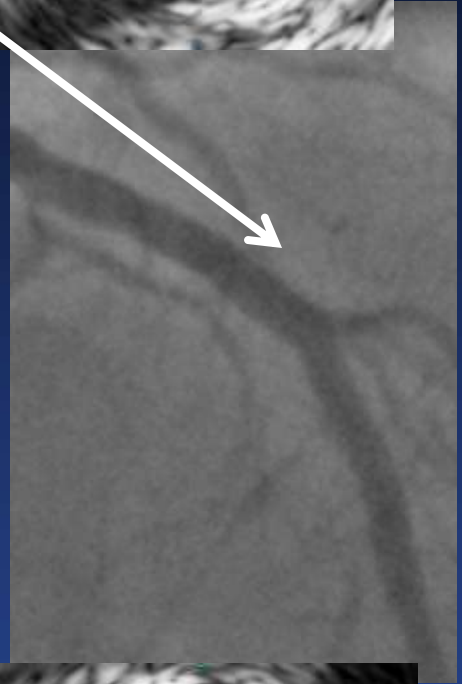
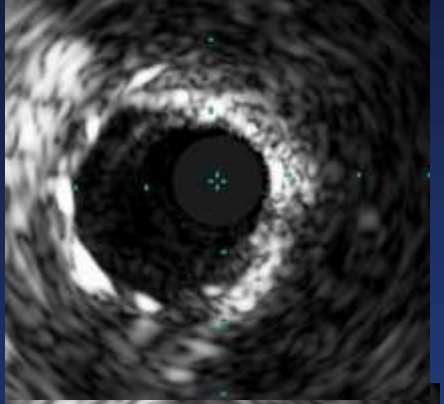
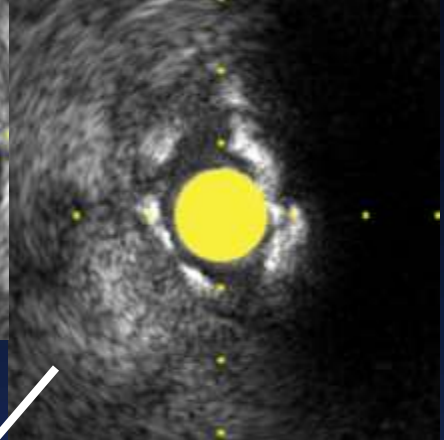
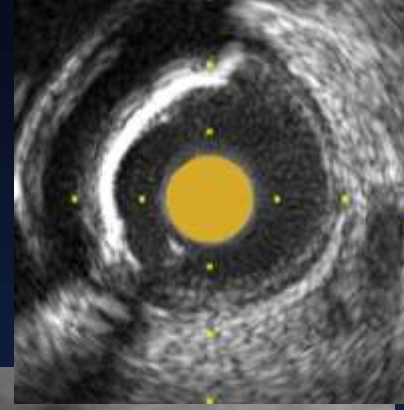
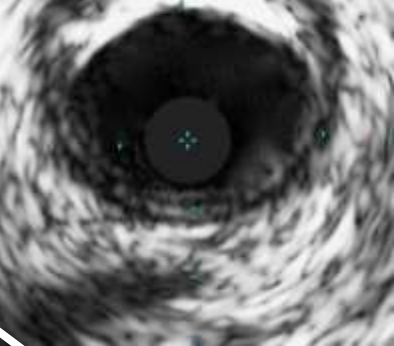
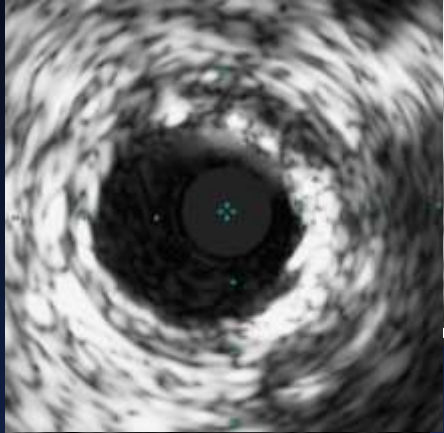


Recurrent angina 6 weeks later



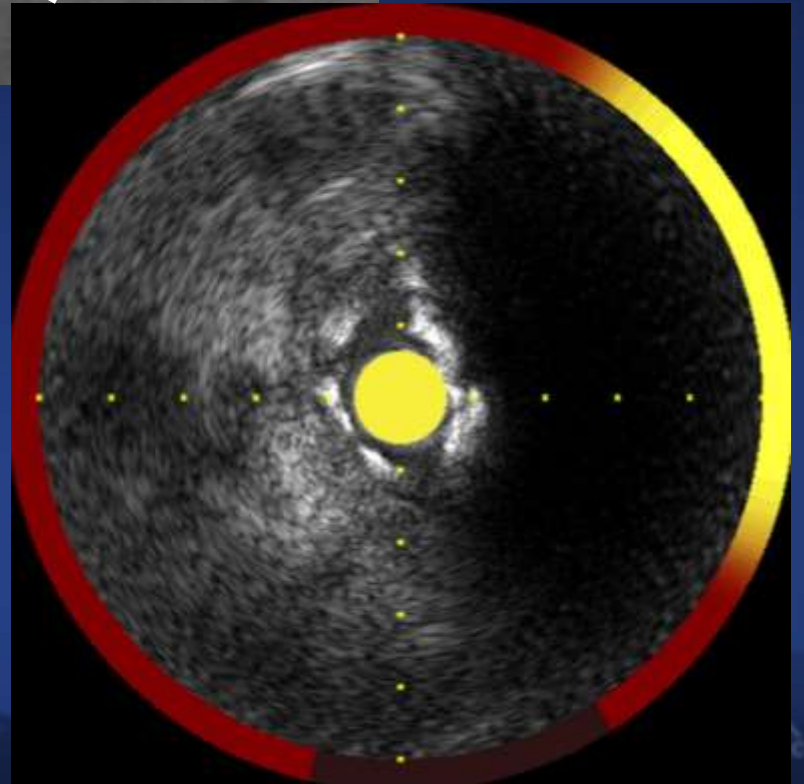
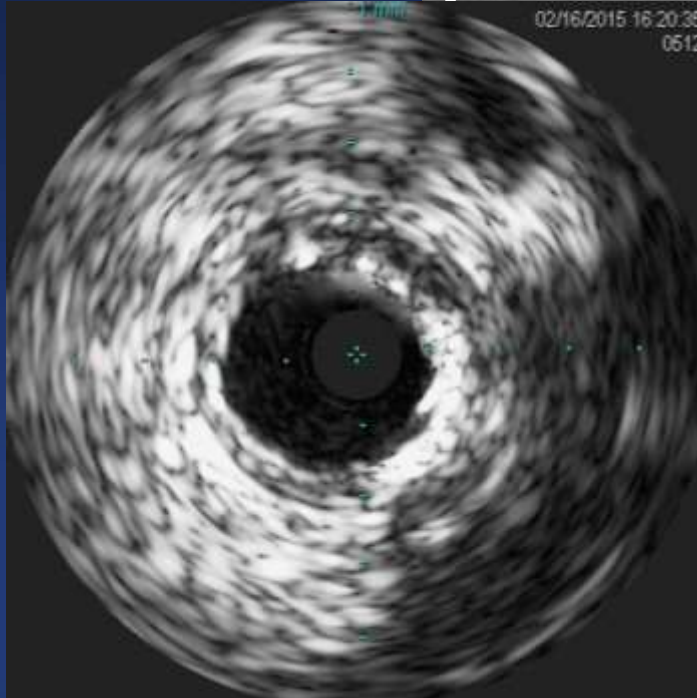
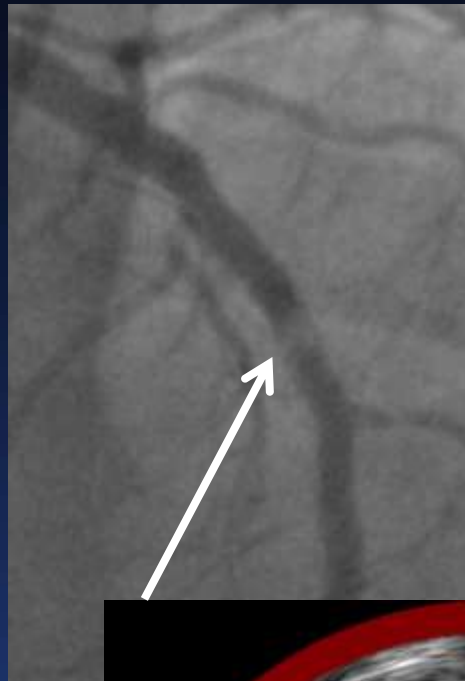
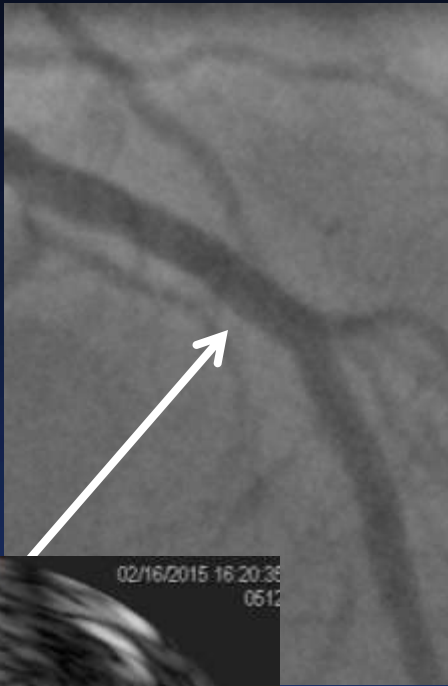
Baseline

6 weeks

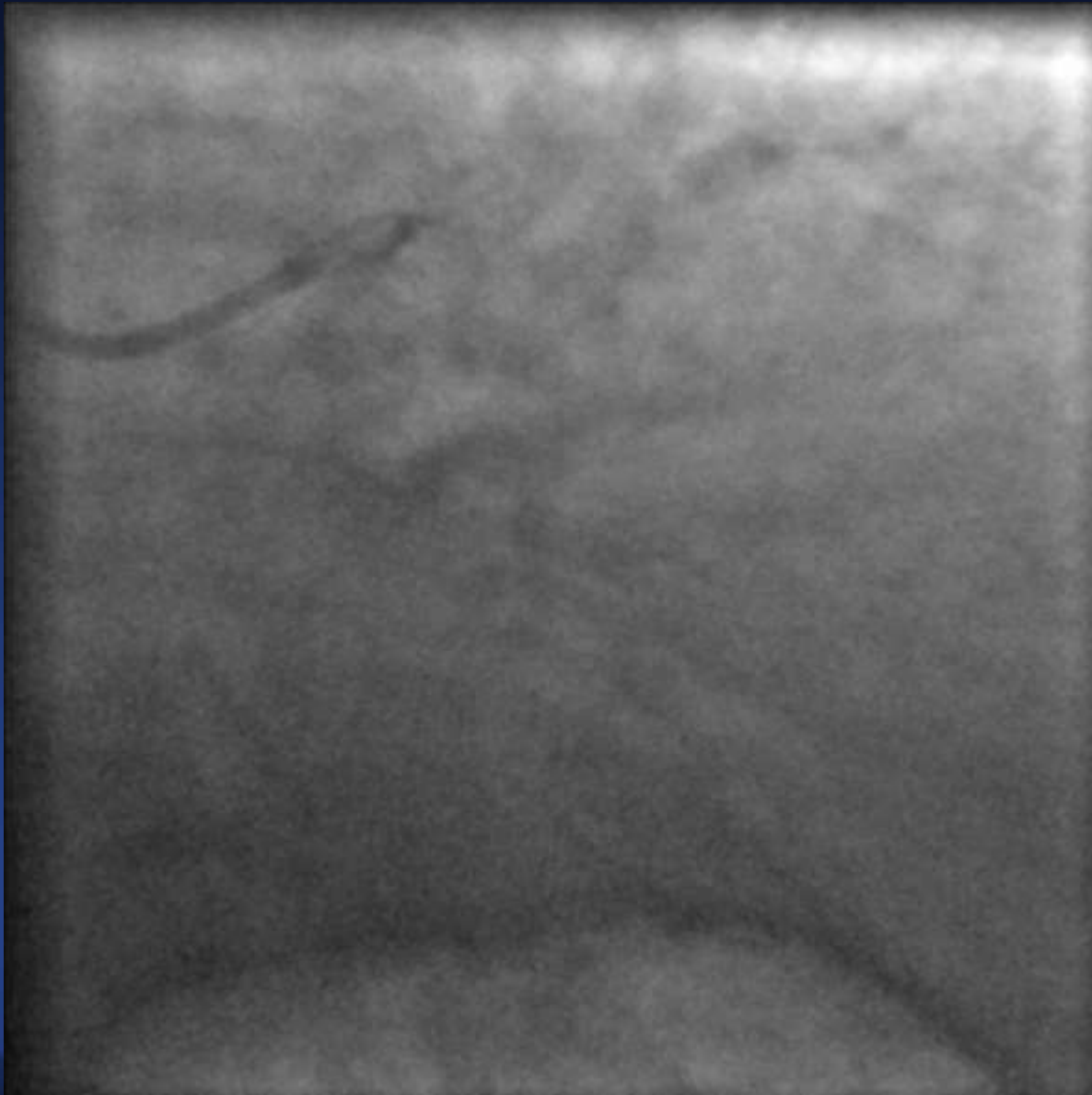


IVUS

NIR IVUS



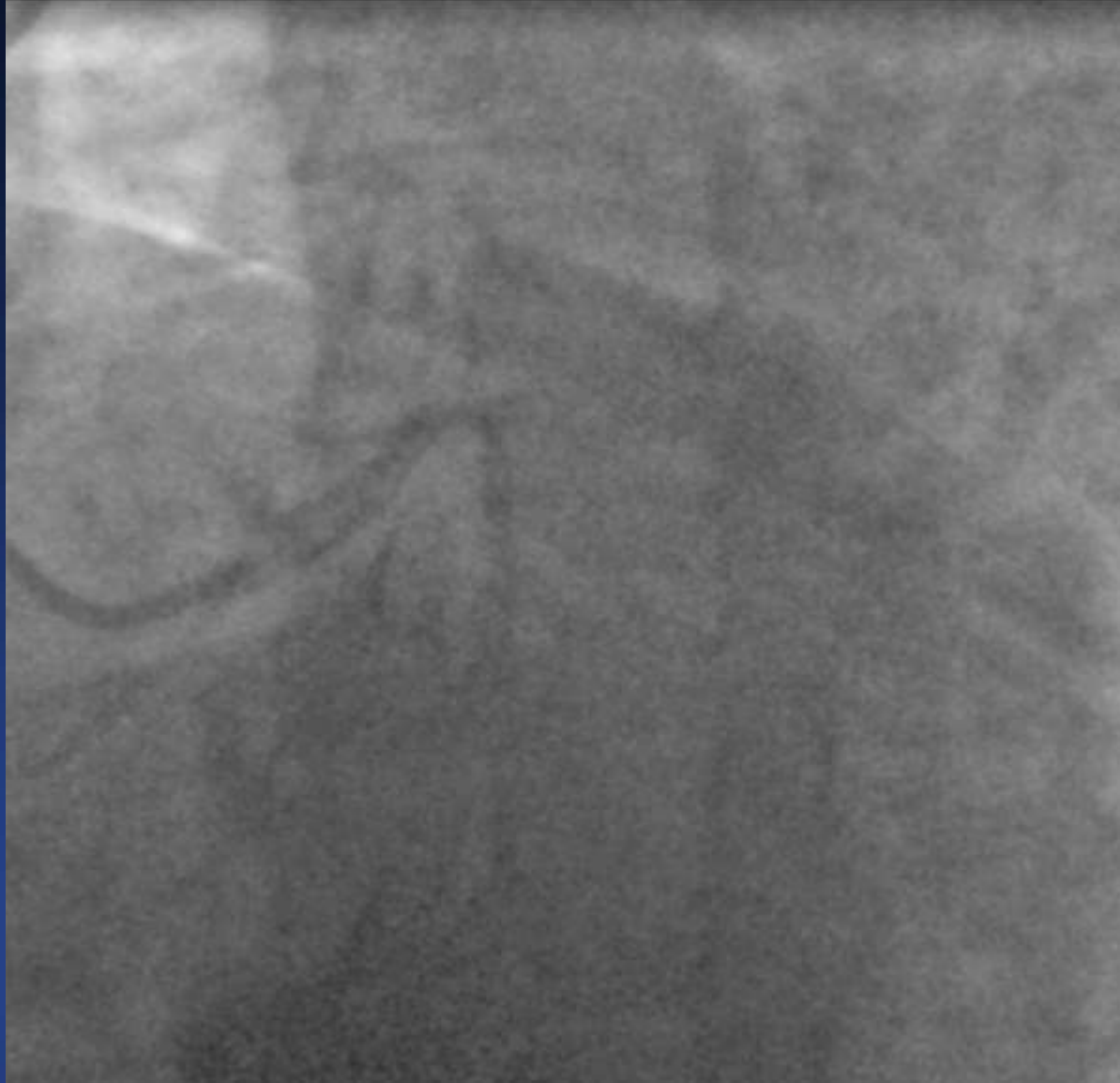
TW: 8/2015 after PCI of LCX



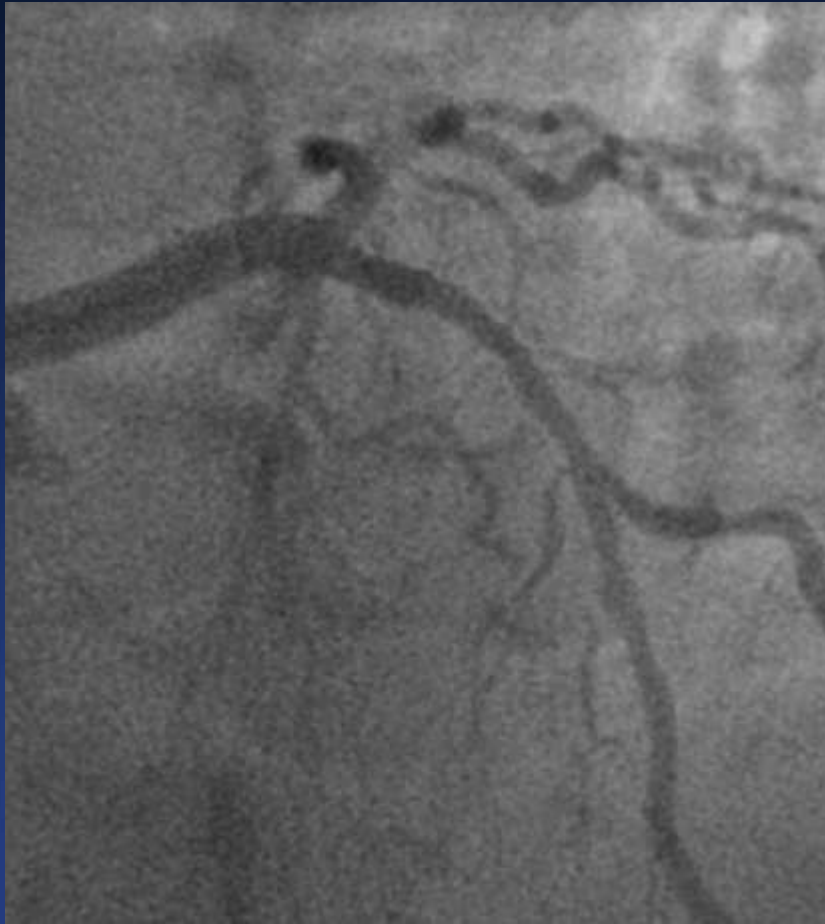
TW: recurrent unstable angina 12/2015



TW: new ostial LAD lesion



TW: Clear new ostial LAD lesion

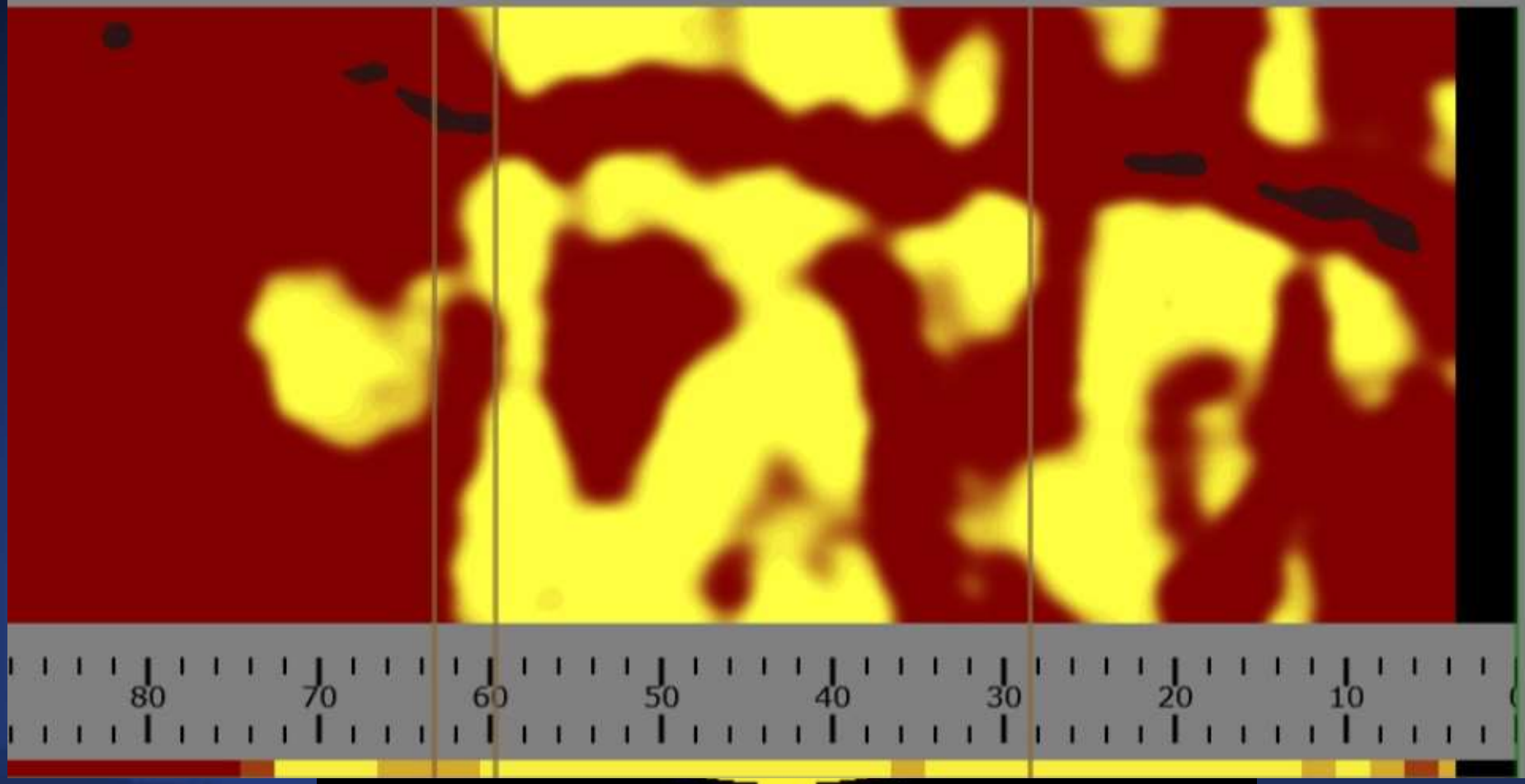


8/2015

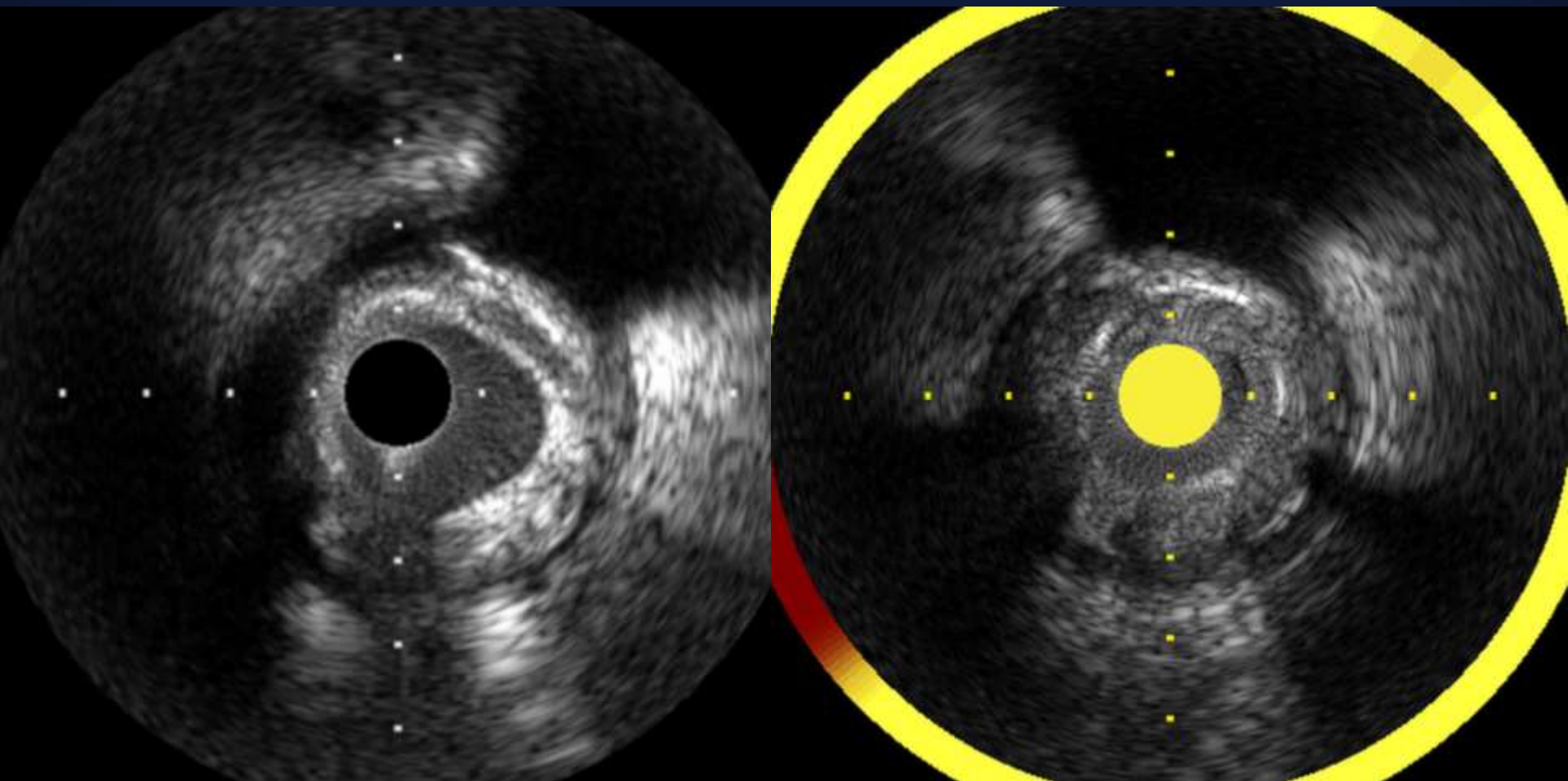


12/2015

TW: IVUS shows huge lipid rich plaque



TW: Calcified plaque actually lipid rich



8/2015

12/2015

Invasive approach

- Identify especially high risk plaques and stent them
 - Being tested in PROSPECT II, PREVENT and LRP studies
 - Not recommended at this time
- Ensure adequate placement of the index stent: avoid geometric miss.
- Identify vulnerable patients for intensified systemic therapy.

Purpose specific devices: 2002

(12) **United States Patent**
Cox et al.

(10) **Patent No.:** **US 6,899,729 B1**
(45) **Date of Patent:** **May 31, 2005**

(54) **STENT FOR TREATING VULNERABLE
PLAQUE**

4,619,246 A 10/1986 Molgaard-Nielsen et al.
4,649,922 A 3/1987 Wiktor
4,650,466 A 3/1987 Luther

(75) Inventors: **Daniel L. Cox**, Palo Alto, CA (US);
Christopher Feezor, Mountain View,
CA (US)

(Continued)

(73) Assignee: **Advanced Cardiovascular Systems,
Inc.**, Santa Clara, CA (US)

FOREIGN PATENT DOCUMENTS

DE 3640745 A1 6/1987

(Continued)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 34 days.

OTHER PUBLICATIONS

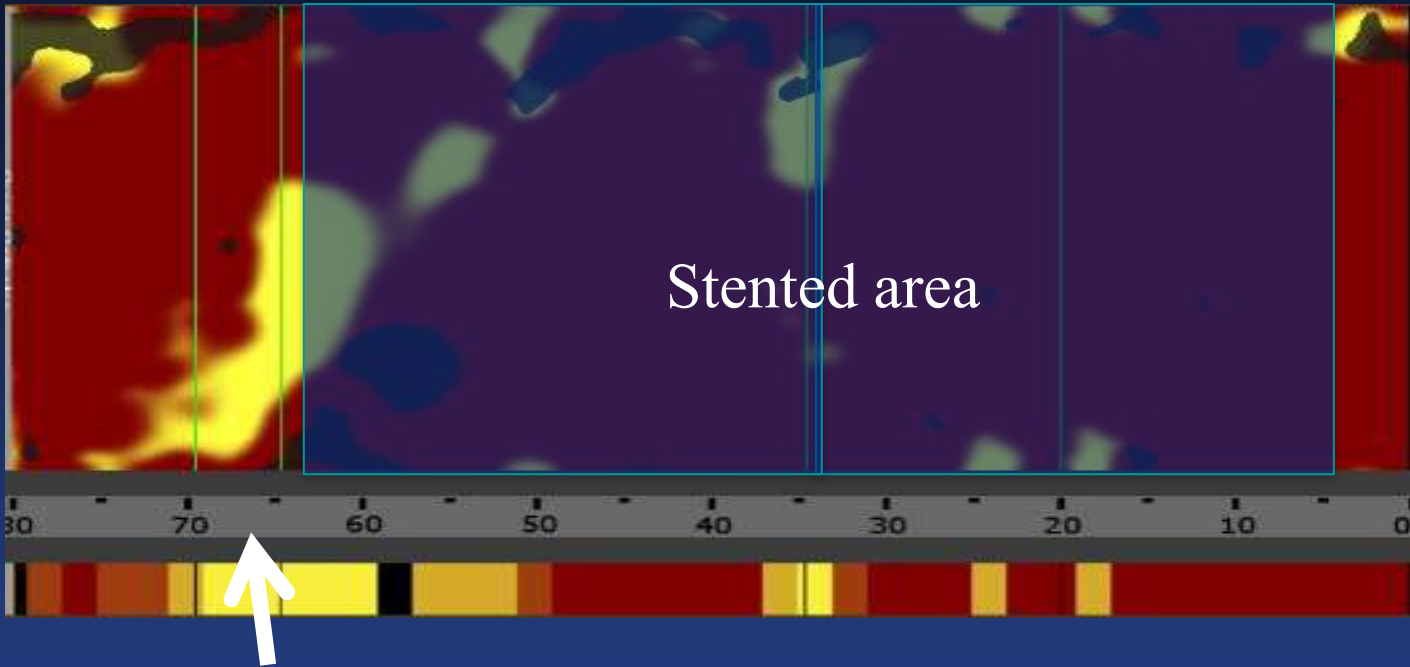
(21) Appl. No.: **10/322,350**

Dotter, Charles T. *Transluminally Placed Coilspring Endarterial Tube Grafts*, *Investigative Radiology*, pp. 329-332, Sep./Oct. 1969.

(22) Filed: **Dec. 18, 2002**

Dotter, Charles T., *Transluminal Expandable Nitinol Coil Stent Grafting: Preliminary Report*, *Radiology Journal*, pp. 259-260, Apr. 1983.

Lipid core plaque and stent placement



Day 241:

--Stenosis at proximal edge of proximal stent

10 cases of restenosis in COLOR Registry.

In 9 of those, the stent ended in a lipid core.

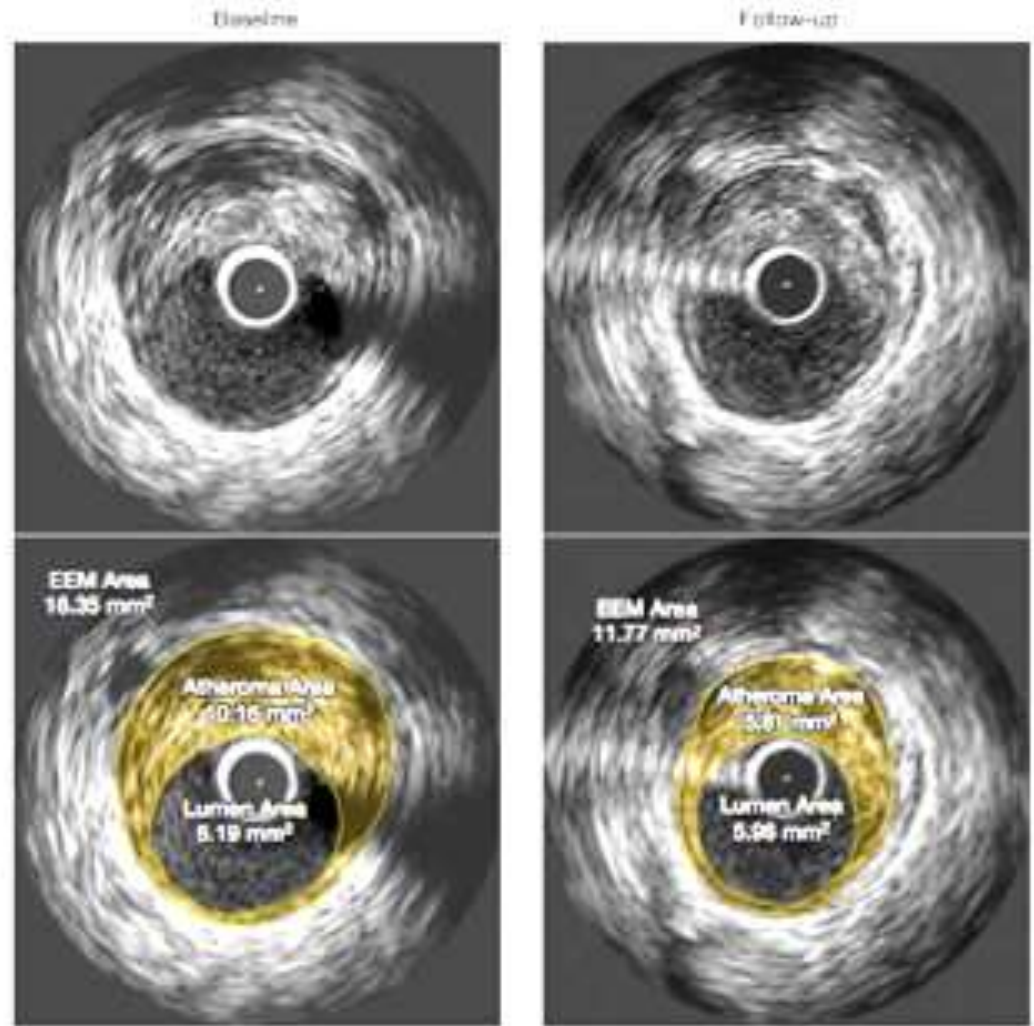
Systemic treatment

- Statins can slow atherosclerosis: REVERSAL, ASTEROID, et al
- Statins can modify plaque: GAIN (IVUS), Fluvastatin (VH-IVUS), YELLOW (NIRS), STABLE (VH-IVUS)
- PCSK-9 inhibitors: GLAGOV. Regression in >80%

Asteroid

Rosuvastatin 40 mg
24 months
LDL: 61 mg/dl
Volume down 6.8%

Figure 2. Example of Regression of Atherosclerosis in a Patient in the Trial

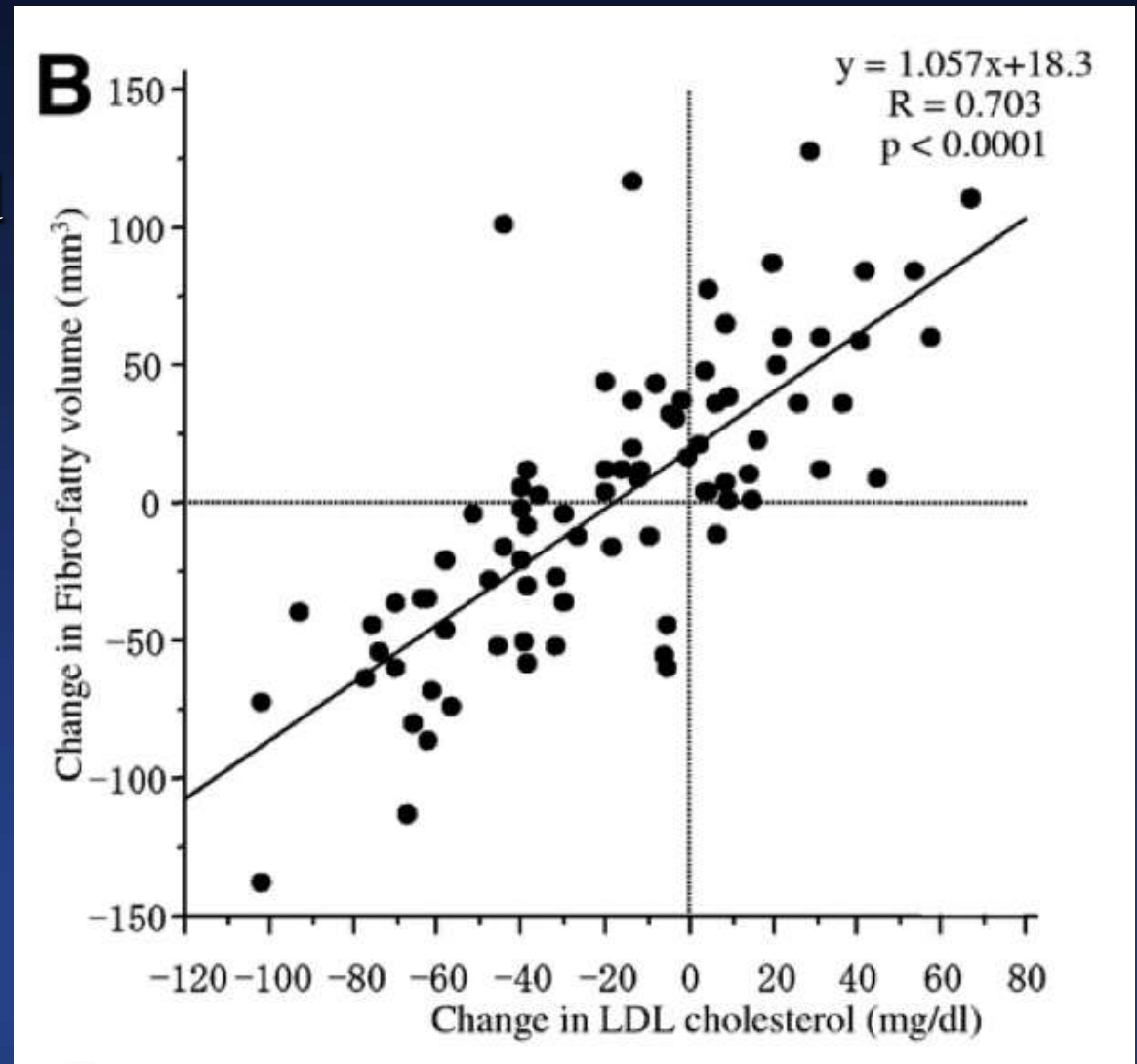


The top left panel illustrates the appearance of a single cross-section at baseline intravascular ultrasound examination, while the top right panel shows the same cross-section after 24 months of treatment. The bottom 2 panels illustrate the same cross sections, but with measurements superimposed. Atheroma area was reduced from 10.16 mm² to 5.01 mm². EEM indicates external elastic membrane.

JAMA 2006;295:epub

Effect of Statins on Fibroatheroma

- Randomized Fluvastatin 60mg/d vs. control (n=80)
- Fibroatheromas detected by VH-IVUS
- Re-study at 12 months



STABLE

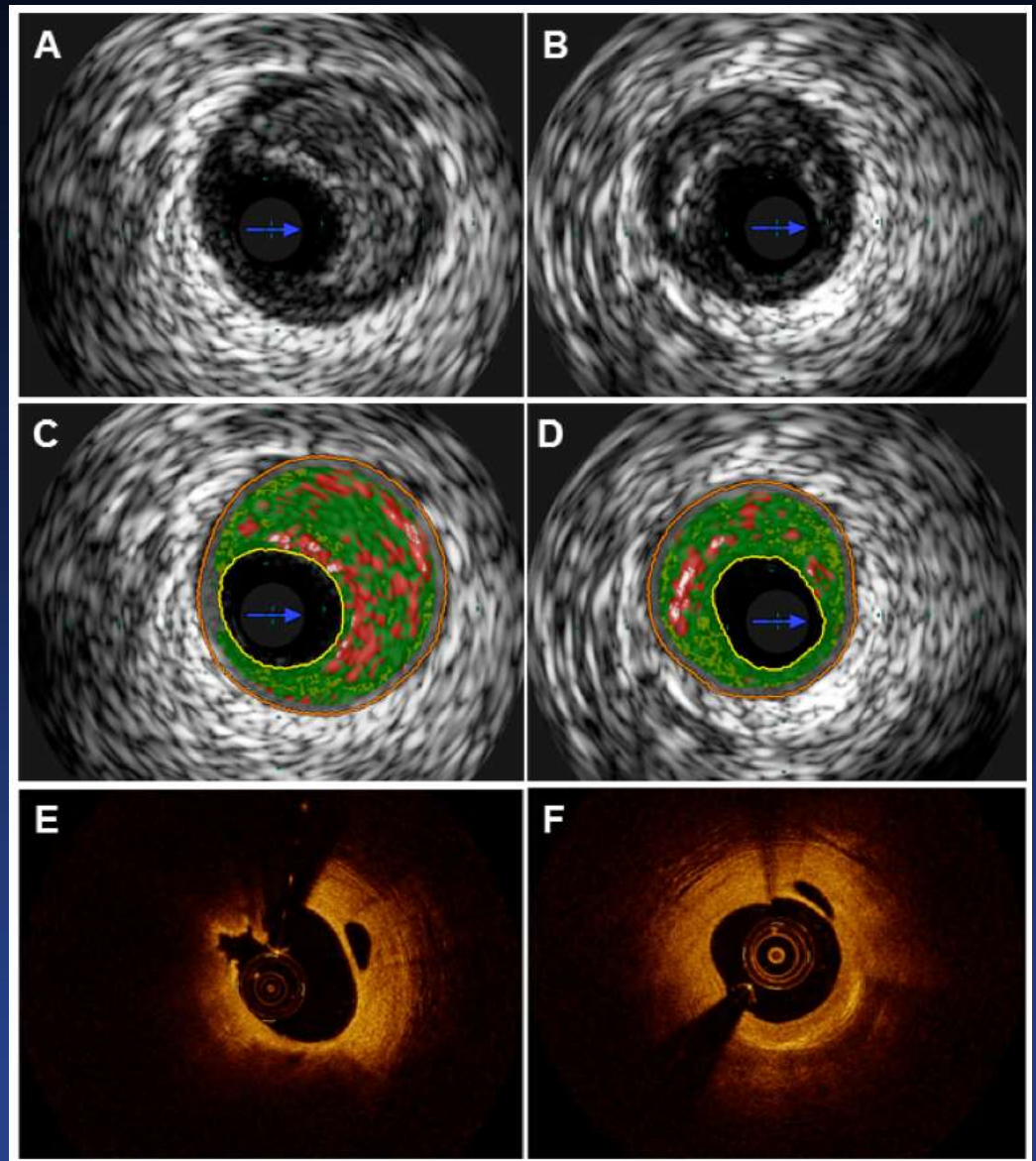
Serial IVUS

VH-IVUS

OCT

Baseline and 1 year

Rosuvastatin Tx



J Am Coll Cardiol 2016;67:1772–83

STABLE: significant reduction in TCFA at 1 yr

Plaque type at index

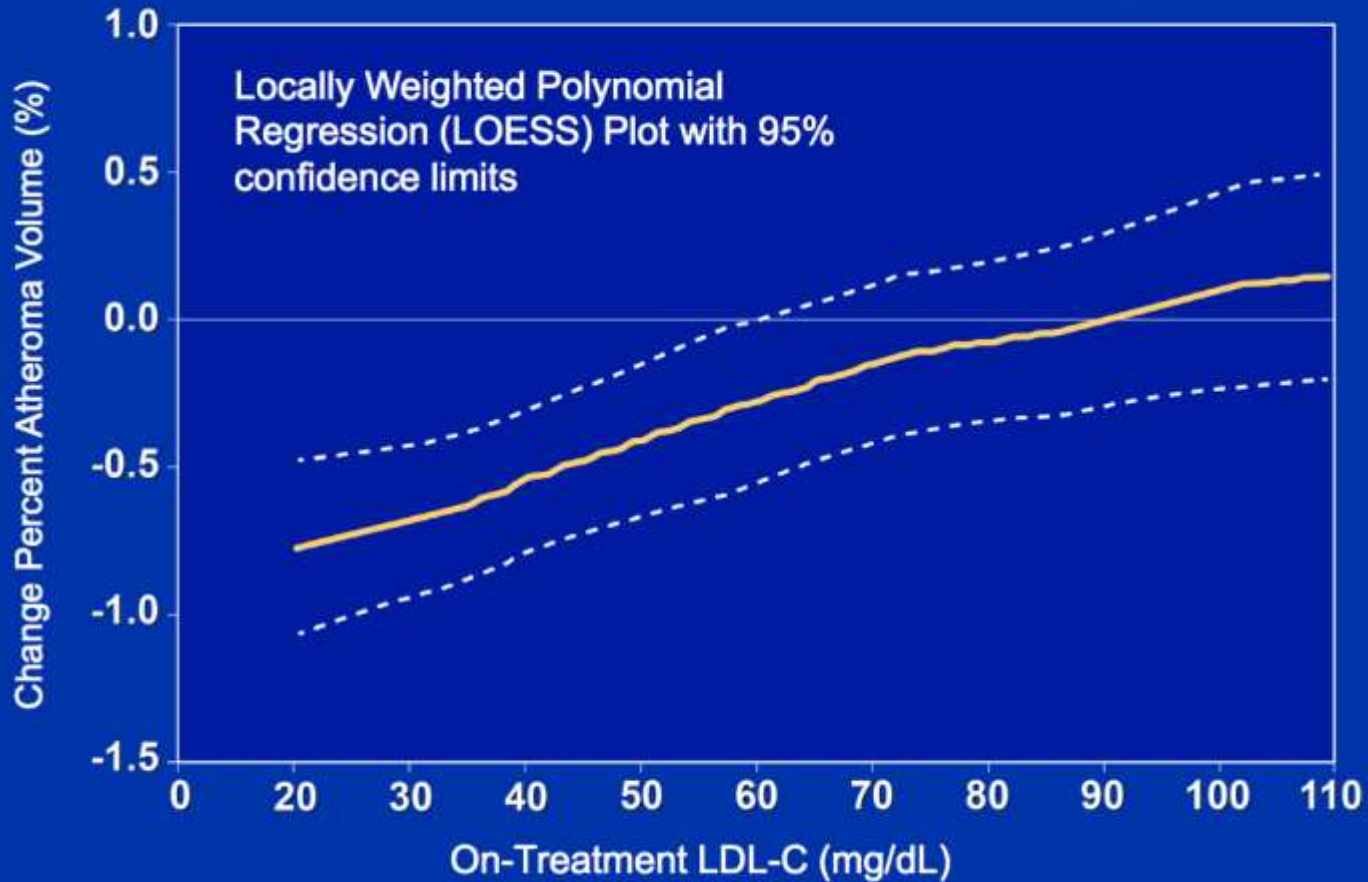
VH-TCFA	123 (54.7)	44 (19.6)
Thick-cap fibroatheroma	102 (45.3)	159 (70.7)
Pathological intimal thickening	0 (0)	19 (8.4)
Fibrous	0 (0)	3 (1.3)
Fibrocalcific	0 (0)	0 (0)

$p < 0.001$

J Am Coll Cardiol 2016;67:1772–83

PCSK-9 Inhibition: really low LDL

Mean On-Treatment LDL-C vs. Change in PAV

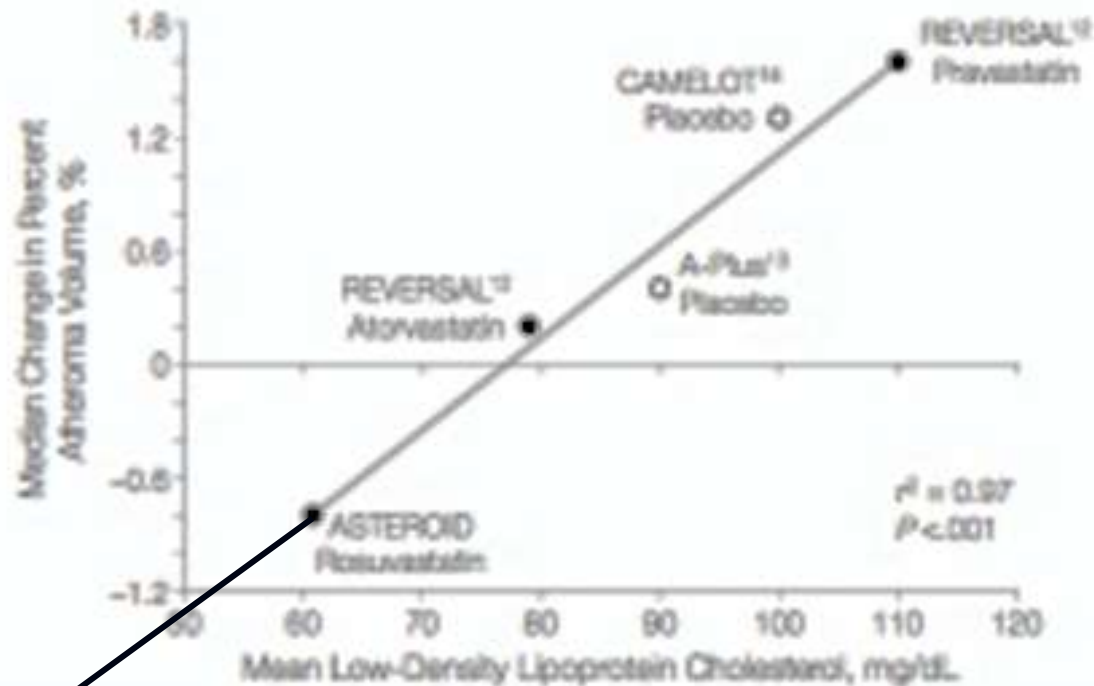


GLAGOV: JAMA 2016

Cardio-oncologists

Statin “chemotherapy”

Figure 3. Relationship Between Mean Low-Density Lipoprotein Cholesterol Levels and Median Change in Percent Atheroma Volume for Several Intravascular Ultrasound Trials



24

-1.97 • GLAGOV PCSK-9

JAMA 2006;295:epub

Summary

- Multiple methods to identify vulnerable plaque
- Can use to ensure proper culprit lesion stent implantation
- Most important use: identifies a patient who deserves optimal LDL reduction therapy
- The use of local therapy, including stents, is under investigation.