Erasmus MC
Universitair Medisch Centrum Rotterdam

TCTAP 2014 Session: Functional Angioplasty

For Vulnerable Plaque: Detect and Treat It Prophylactically!

E. Regar,
prepared with A. Karanasos & J. van der Sijde

Thoraxcenter
Erasmus Medical Center
Rotterdam, NL

The FAME of treating ischemia

Rather than FAME, give me truth.
Henry David Thoreau

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JANUARY 15, 2009 VOL. 360 NO. 3

Fractional Flow Reserve versus Angiography for Guiding Percutaneous Coronary Intervention

Pim A.L. Tonino, M.D., Bernard De Bruyne, M.D., Ph.D., Nico H.J. Pijls, M.D., Ph.D., Uwe Siebert, M.D., M.P.H., Sc.D., Fumiaki Ikeno, M.D., Marcel van 't Veer, M.Sc., Volker Klauss, M.D., Ph.D., Ganesh Manoharan, M.D., Thomas Engstrøm, M.D., Ph.D., Keith G. Oldroyd, M.D., Peter N. Ver Lee, M.D., Philip A. MacCarthy, M.D., Ph.D., and William F. Fearon, M.D., for the FAME Study Investigators*

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 SEPTEMBER 13, 2012 VOL. 367 NO. 11

Fractional Flow Reserve–Guided PCI versus Medical Therapy in Stable Coronary Disease

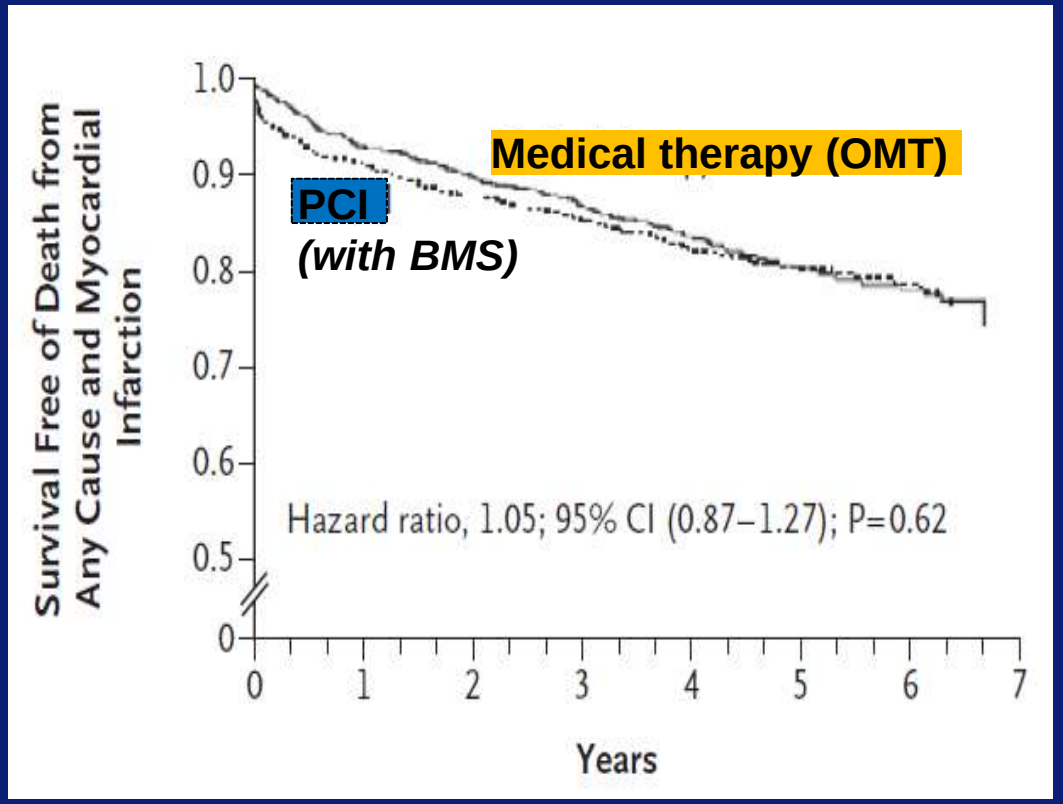
Bernard De Bruyne, M.D., Ph.D., Nico H.J. Pijls, M.D., Ph.D., Bindu Kalesan, M.P.H., Emanuele Barbato, M.D., Ph.D., Pim A.L. Tonino, M.D., Ph.D., Zsolt Piroth, M.D., Nikola Jagic, M.D., Sven Möbius-Winkler, M.D., Gilles Rioufol, M.D., Ph.D., Nils Witt, M.D., Ph.D., Petr Kala, M.D., Philip MacCarthy, M.D., Thomas Engström, M.D., Keith G. Oldroyd, M.D., Kreton Mavromatis, M.D., Ganesh Manoharan, M.D., Peter Verlee, M.D., Ole Frobert, M.D., Nick Curzen, B.M., Ph.D., Jane B. Johnson, R.N., B.S.N., Peter Jüni, M.D., and William F. Fearon, M.D., for the FAME 2 Trial Investigators*

The TRUTH of treating CAD

COURAGE study

FACT #1: PCI in stable patients does not reduce hard events

NO DIFFERENCE IN DEATH OR MI
in pts with stable angina treated with PCI vs. OMT



MI	*myocardial infarction*
BMS	*bare metal stent*
OMT	*optimal medical therapy*

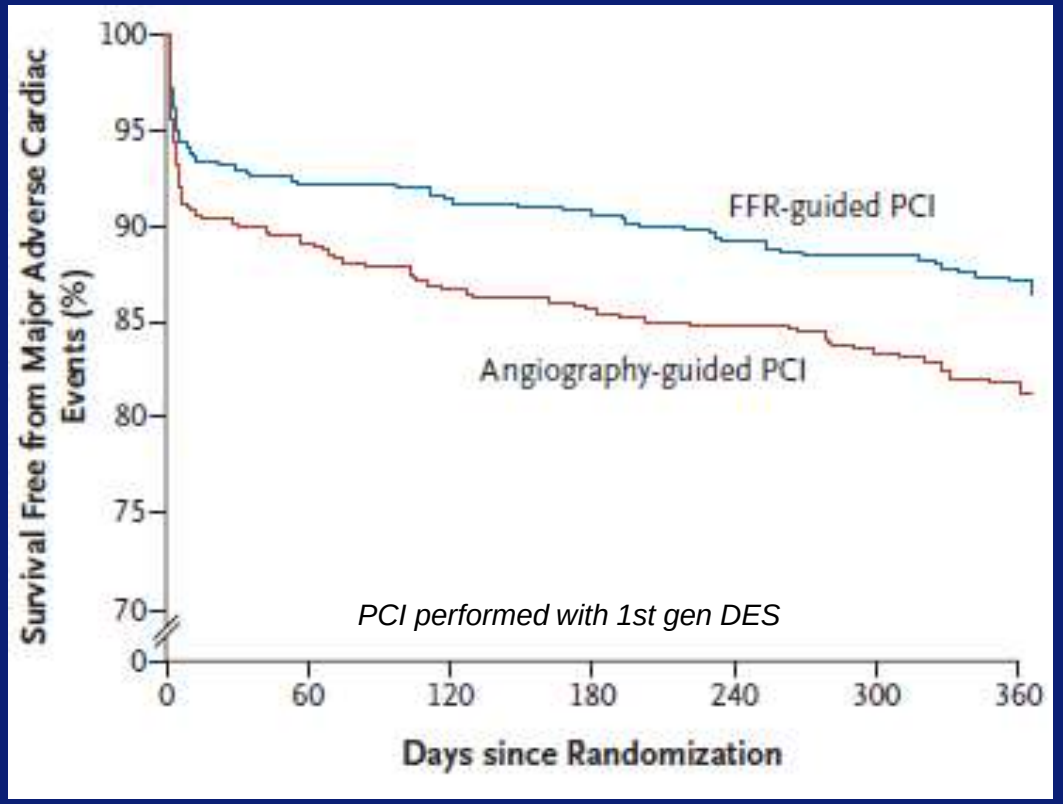
Boden et al. N Eng J Med 2007

The TRUTH of treating CAD

FAME study

FACT #2: PCI - Not all lesions should be treated

HIGHER MACE RATE with eyeballing (=angiography) vs. ischemia-guided (=FFR) strategy in pts with stable or unstable angina



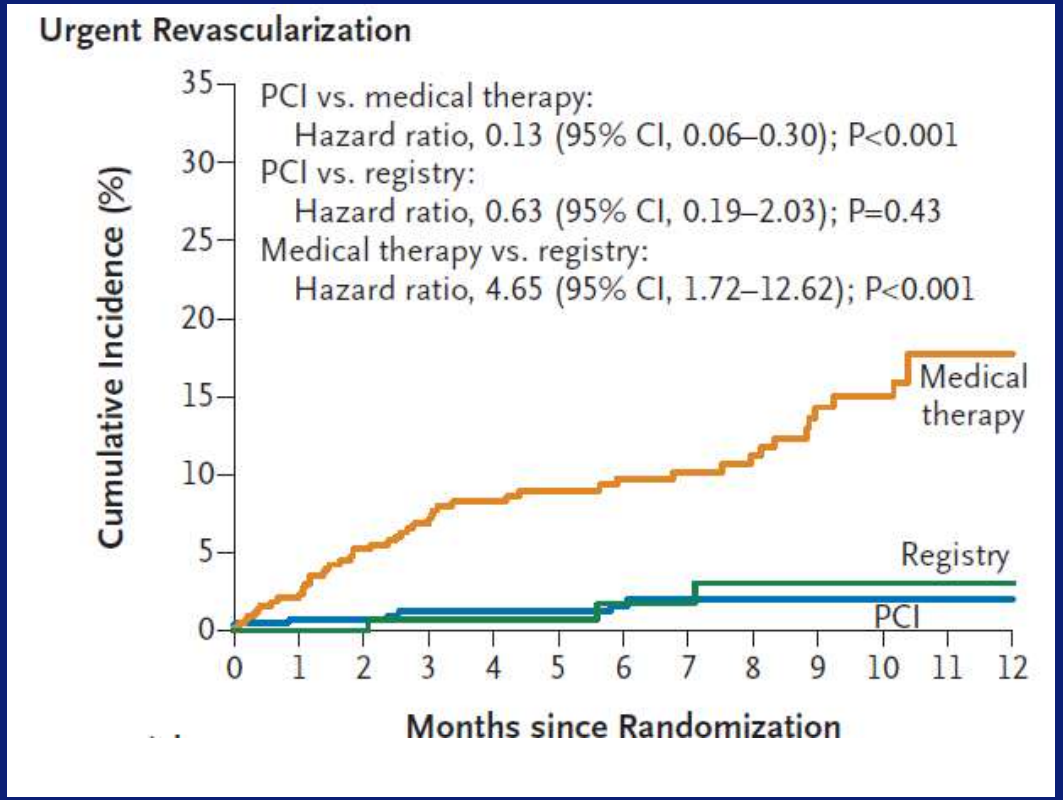
Tonino et al. N Eng J Med 2009

The TRUTH of treating CAD

FAME 2 study

FACT #3: Treating ischemia reduces the need for repeat PCI (versus OMT)

LOWER URGENT REVASCULARIZATION in pts with stable angina treated with **ischemia-guided PCI** vs. OMT



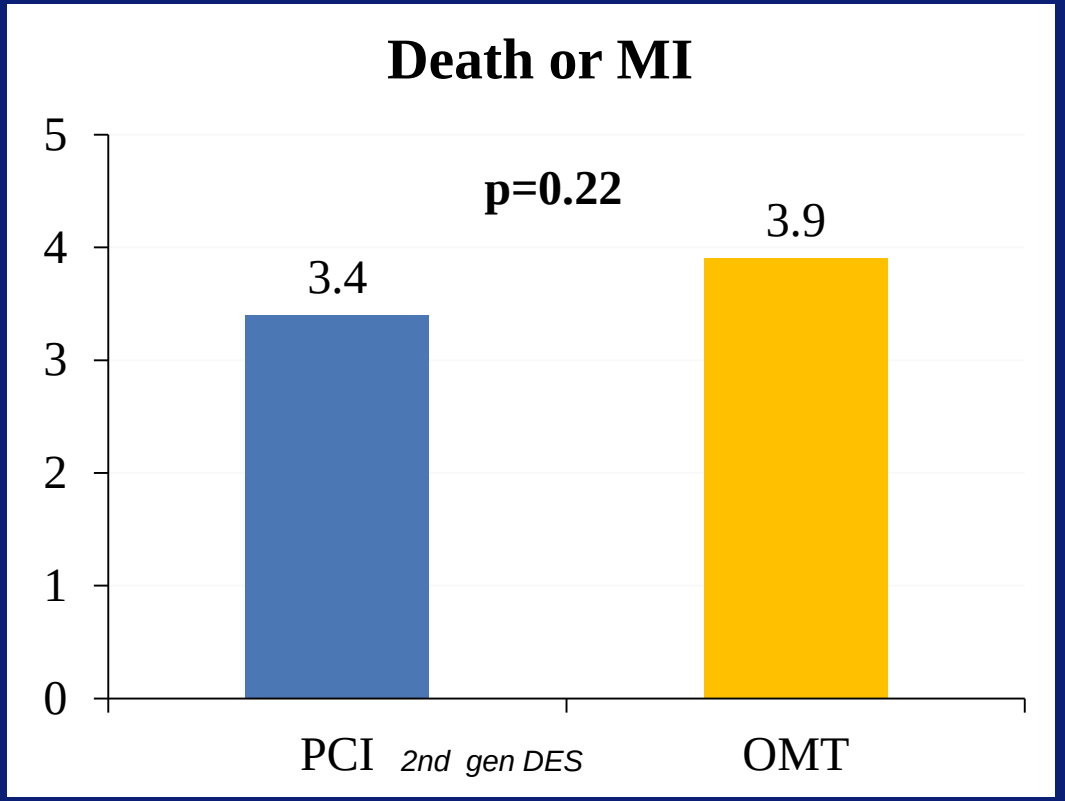
De Bruyne et al. N Eng J Med 2012

The TRUTH of treating CAD

FAME 2 study

FACT #4: Treating ischemia with PCI does not reduce hard events

NO DIFFERENCE IN DEATH OR MI
in pts with stable angina treated with ischemia-guided PCI vs. OMT



ISCHEMIA trial will give a definite answer (est completion 2018)

De Bruyne et al. N Eng J Med 2012

The TRUTH of treating CAD

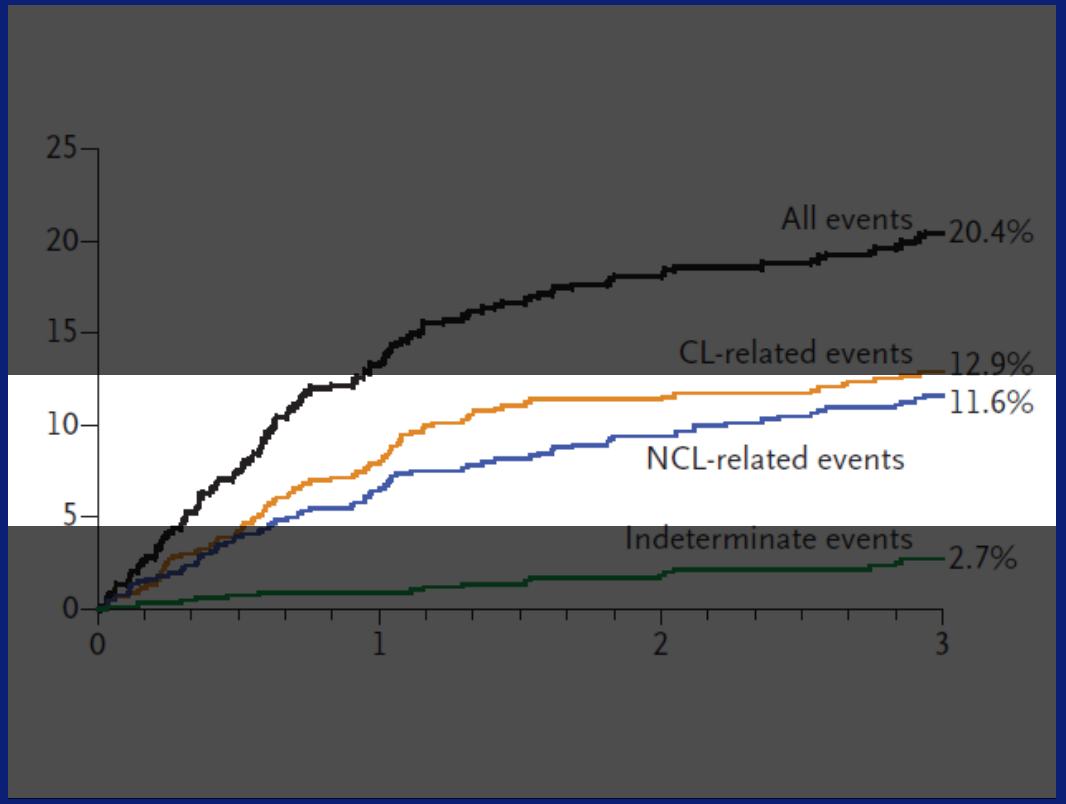
FACT #5: In ACS PCI is life-saving,

The TRUTH of treating CAD

PROSPECT study

FACT #5: In ACS, PCI is life-saving, however, non-culprit lesion related events are high, despite OMT

12% EVENT RATE
due to non-culprit lesions at 3 years in pts with ACS



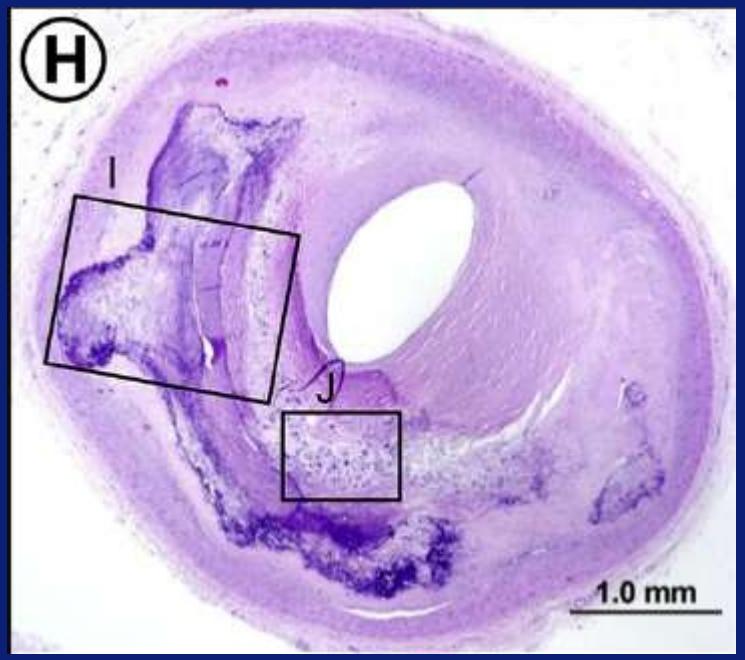
ACS	*acute coronary syndrome*
NCL	*non-culprit lesion*
OMT	*optimal medical therapy*

Stone et al. N Eng J Med 2011

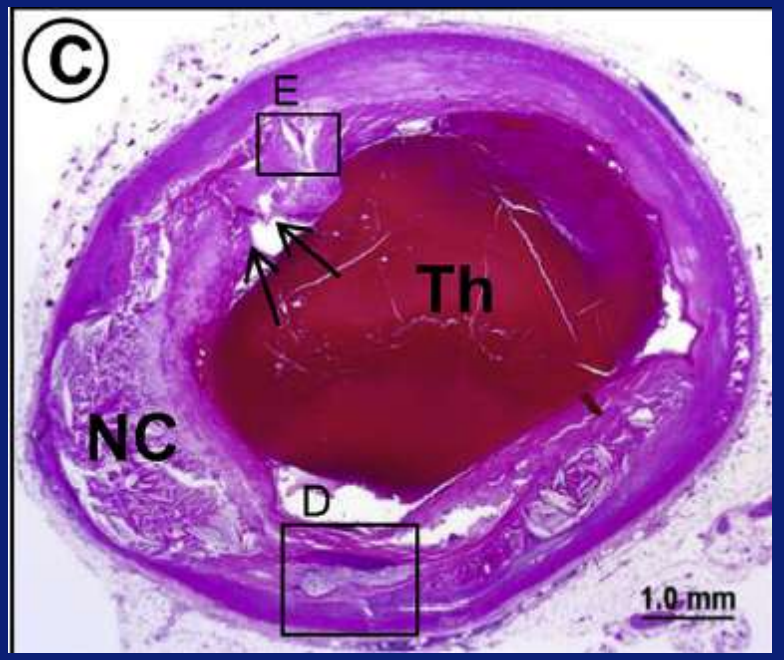
The TRUTH of treating CAD

Insights from pathology

FACT #6: Plaques producing ischemia have different morphology than plaques causing ACS



Fibrocalcific plaque
FLOW LIMITATION



Ruptured plaque
ACS

Otsuka et al. Atherosclerosis 2013

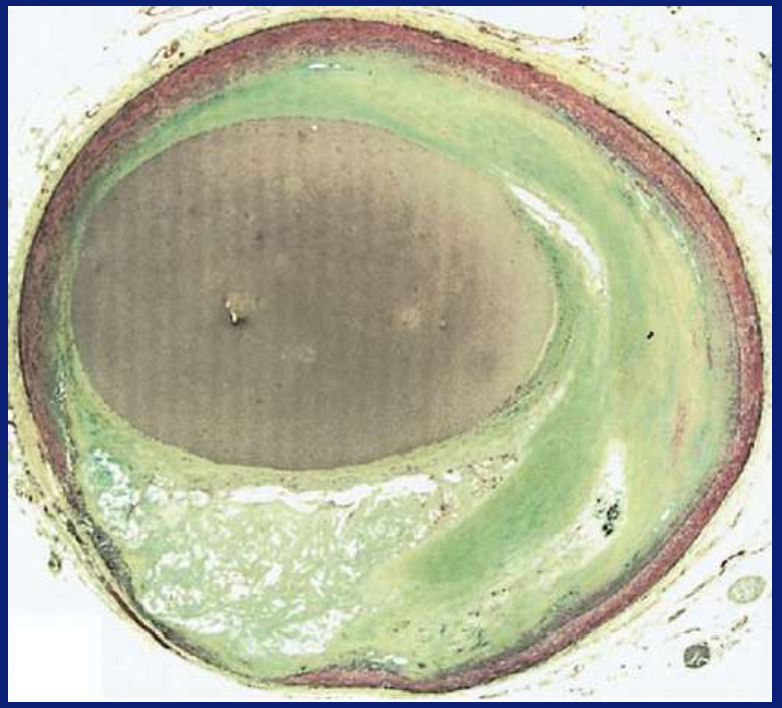
The TRUTH of treating CAD

Insights from pathology

FACT #6: Plaques producing ischemia have different morphology than plaques causing ACS

Thin-cap fibroatheroma:

- **Thin fibrous cap**
- **Large necrotic core**
- **Positive remodeling**



VULNERABLE PLAQUE

Virmani et al. JACC 2006

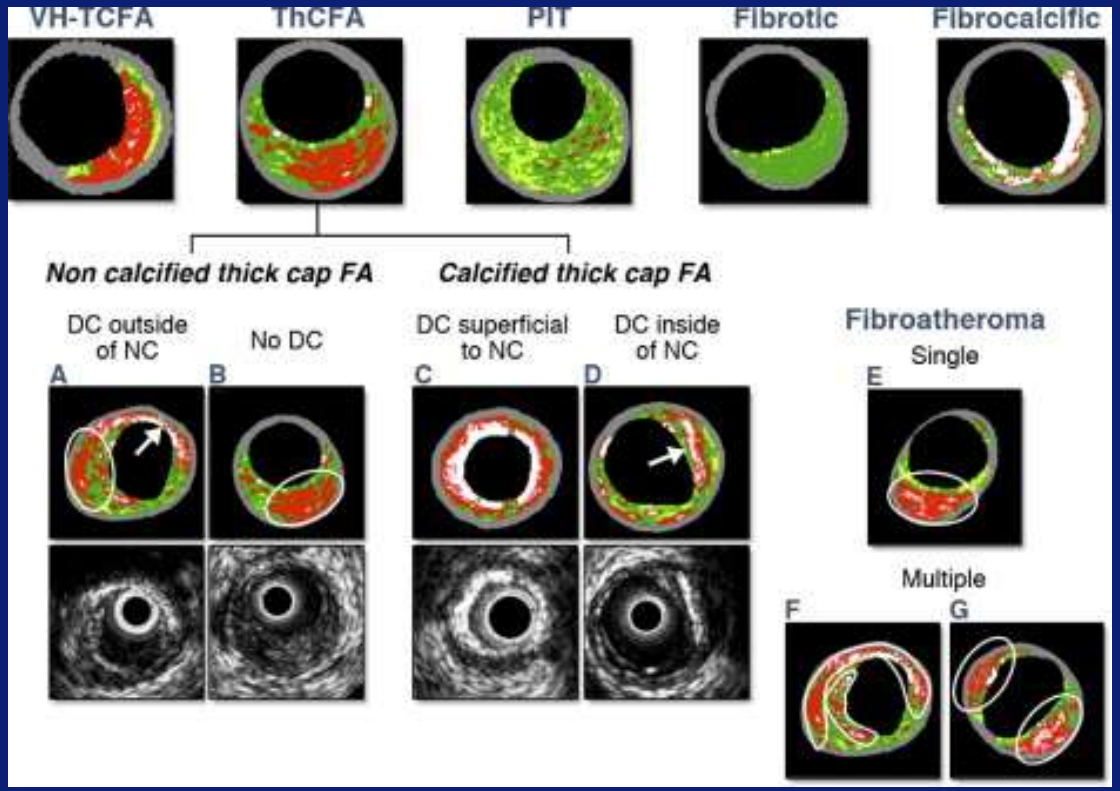
The TRUTH of treating CAD

Insights from in vivo imaging

FACT #7: Vulnerable plaque can be imaged in vivo VH-IVUS

Plaque types can be differentiated by VH-IVUS

Low resolution → overestimation of TCFA



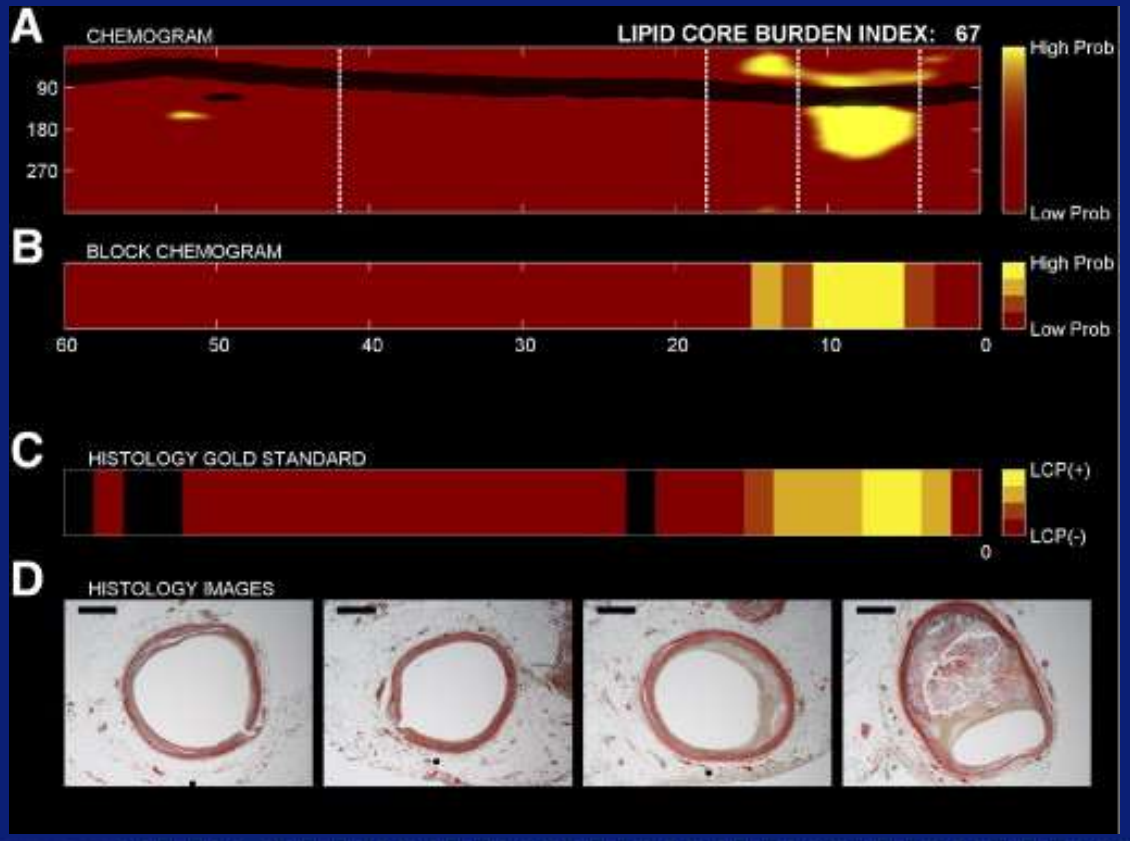
Maehara et al. JACC Img 2012

The TRUTH of treating CAD

Insights from in vivo imaging

FACT #7: Vulnerable plaque can be imaged in vivo Near-infrared spectroscopy

Chemical detection of necrotic core



Gardner et al. JACC Img 2008

The TRUTH of treating CAD

Insights from in vivo imaging

FACT #7: Vulnerable plaque can be imaged in vivo OCT

REVIEW

Expert review document on methodology, terminology, and clinical applications of optical coherence tomography: physical principles, methodology of image acquisition, and clinical application for assessment of coronary arteries and atherosclerosis

Francesco Prati[1*], Evelyn Regar[2], Gary S. Mintz[3], Eloisa Arbustini[4], Carlo Di Mario[5], Ik-Kyung Jang[6], Takashi Akasaka[7], Marco Costa[8], Giulio Guagliumi[9], Eberhard Grube[10], Yukio Ozaki[11], Fausto Pinto[12], and Patrick W.J. Serruys[2] for the Expert's OCT Review Document

CURRENT OPINION

Expert review document part 2: methodology, terminology and clinical applications of optical coherence tomography for the assessment of interventional procedures

Francesco Prati[1,2*], Giulio Guagliumi[3], Gary S. Mintz[4], Marco Costa[5], Evelyn Regar[4,7], Takashi Akasaka[8], Peter Barlis[9], Guillermo J. Tearney[10,11], Ik-Kyung Jang[12], Elosia Arbustini[13], Hiram G. Bezerra[5], Yukio Ozaki[14], Nico Bruining[6,7], Darius Dudek[15], Maria Radu[6,7], Andrejs Erglis[16], Pascale Motreff[17], Fernando Alfonso[18], Kostas Toutouzas[19], Nieves Gonzalo[20], Corrado Tamburino[21], Tom Adriaenssens[22], Fausto Pinto[23], Patrick W.J. Serruys[6,7], and Carlo Di Mario[24,25], for the Expert's OCT Review Document

MINI-FOCUS ISSUE: OPTICAL COHERENCE TOMOGRAPHY

Clinical Research

Consensus Standards for Acquisition, Measurement, and Reporting of Intravascular Optical Coherence Tomography Studies

A Report From the International Working Group for Intravascular Optical Coherence Tomography Standardization and Validation

Guillermo J. Tearney, MD, PhD, *Writing Committee Co-Chair,**
Evelyn Regar, MD, PhD, *Writing Committee Co-Chair,†* Takashi Akasaka, MD, *Writing Committee Co-Chair,‡*
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Nico Bruining, PhD, Jin-man Cho, MD, PhD, Saqib Chowdhary, PhD, Marco A. Costa, MD, PhD,
Ranil de Silva, MD, PhD, Jouke Dijkstra, PhD, Carlo Di Mario, MD, PhD, Darius Dudeck, MD, PhD,
Erlin Falk, MD, PhD, Marc D. Feldman, MD, Peter Fitzgerald, MD, Hector Garcia, MD,
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Yasuhiro Honda, MD, Fumiaki Ikeno, MD, Masanori Kawasaki, MD, Janusz Kochman, MD, PhD,
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Arkadiusz Pietrasik, MD, Francesco Prati, MD, Lorenz Räber, MD, Maria D. Radu, MD,
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Patrick W. J. C. Serruys, MD, PhD, Kenei Shimada, MD, Toshiro Shinke, MD, Junya Shite, MD,
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Giovanni J. Ughi, PhD, Heleen M.M. van Beusekom, PhD, Antonius F.W. van der Steen, PhD,
Gerrit-Ann van Es, PhD, Gijs van Soest, PhD, Renu Virmani, MD, Sergio Waxman, MD,
Neil J. Weissman, MD, Giora Weisz, MD

Boston, Massachusetts; Rotterdam, the Netherlands; and Wakayama, Japan

The International Working Group
For Intracoronary OCT Standardization And Validation

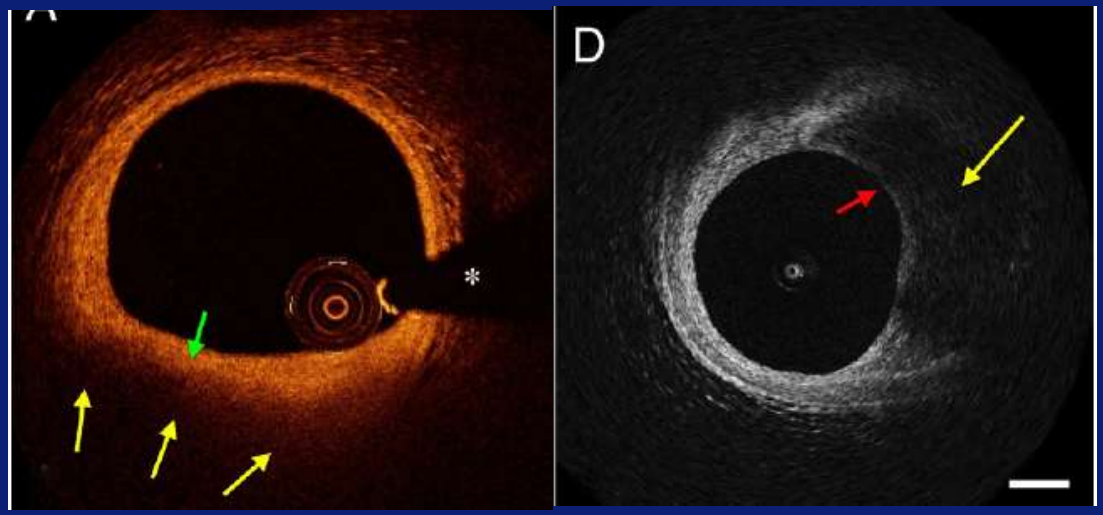
The TRUTH of treating CAD

Insights from in vivo imaging

FACT #7: Vulnerable plaque can be imaged in vivo OCT

Detection of:

- **Lipid-rich plaque**
- **Thin fibrous cap**



Fibroatheroma with poorly defined borders and a cap

Fibroatheroma with thin fibrous cap

Evidence level: High

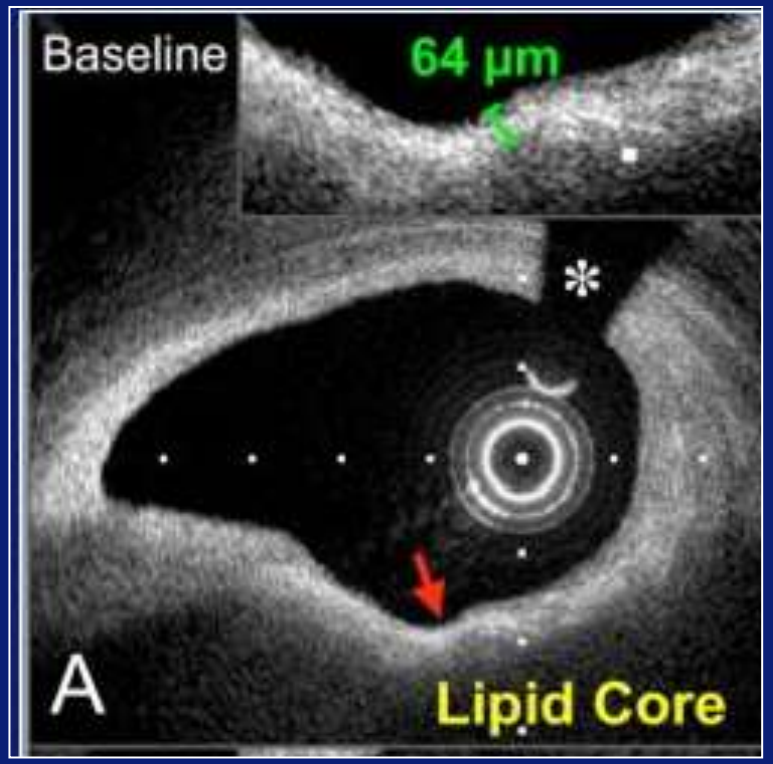
The International Working Group For Intracoronary OCT Standardization And Validation

Tearney, Regar, Akasaka et al. JACC 2006

The TRUTH of treating CAD

Insights from in vivo imaging

FACT #7: Vulnerable plaque can be imaged in vivo OCT



Gonzalo N et al. JACC Imaging. 2011

The TRUTH of treating CAD

Insights from in vivo imaging

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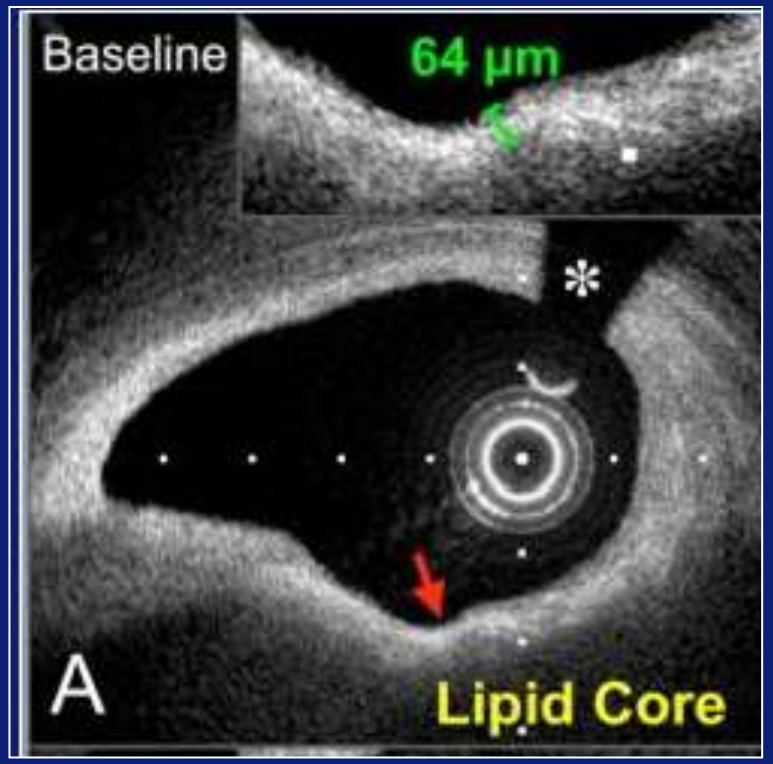

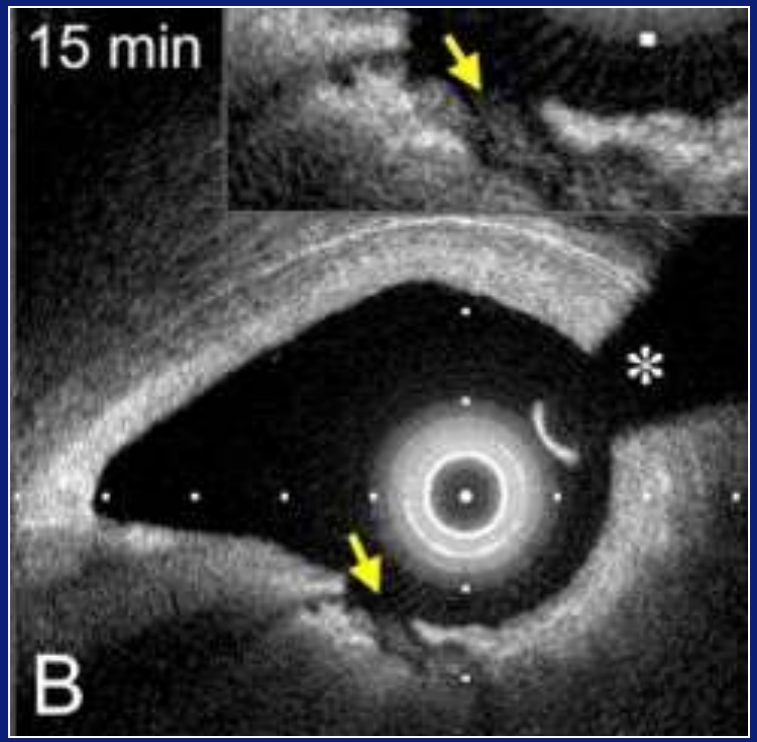

Gonzalo N et al. JACC Imaging. 2011

The TRUTH of treating CAD

Insights from in vivo imaging

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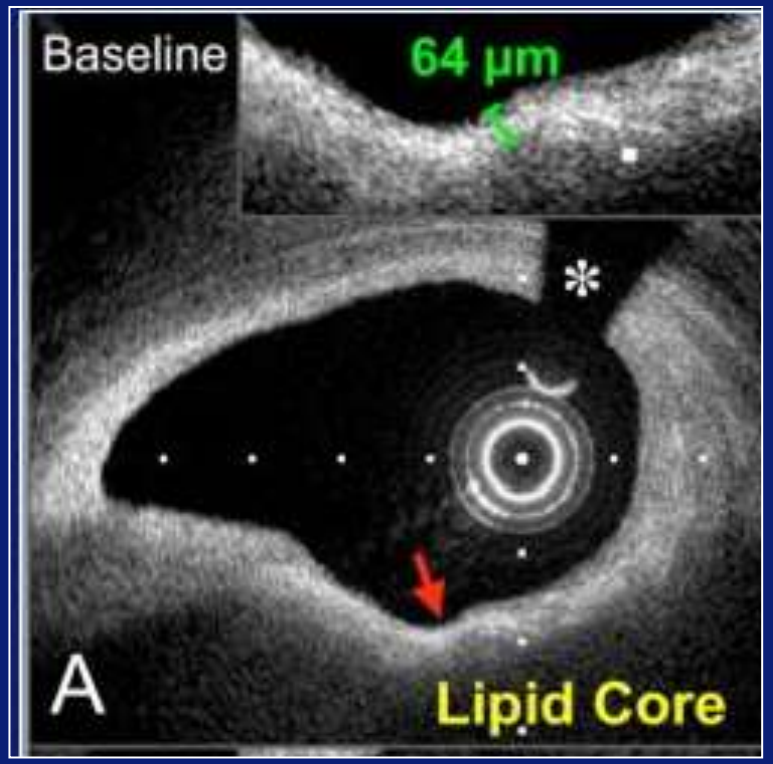

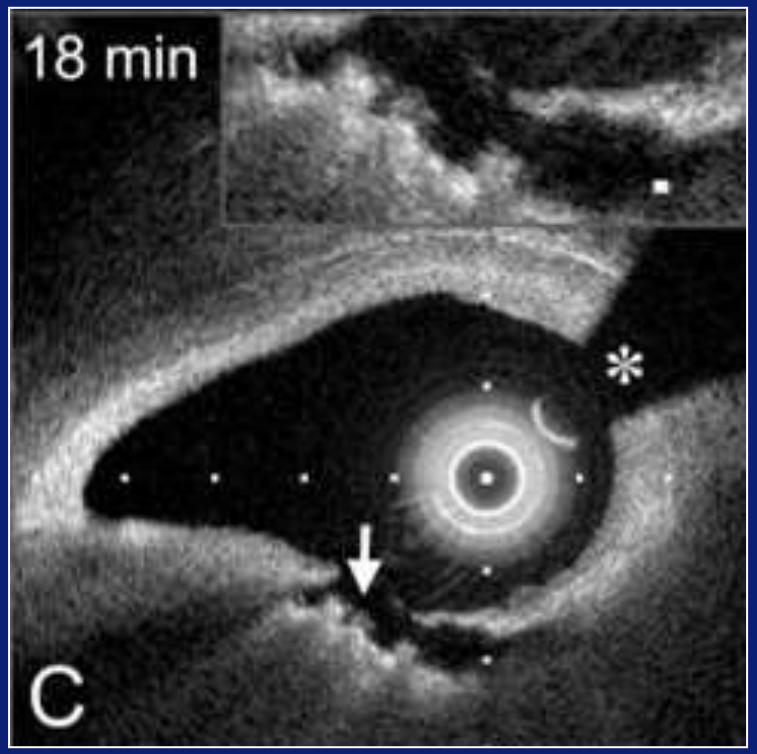

Gonzalo N et al. JACC Imaging. 2011

The TRUTH of treating CAD

Insights from in vivo imaging

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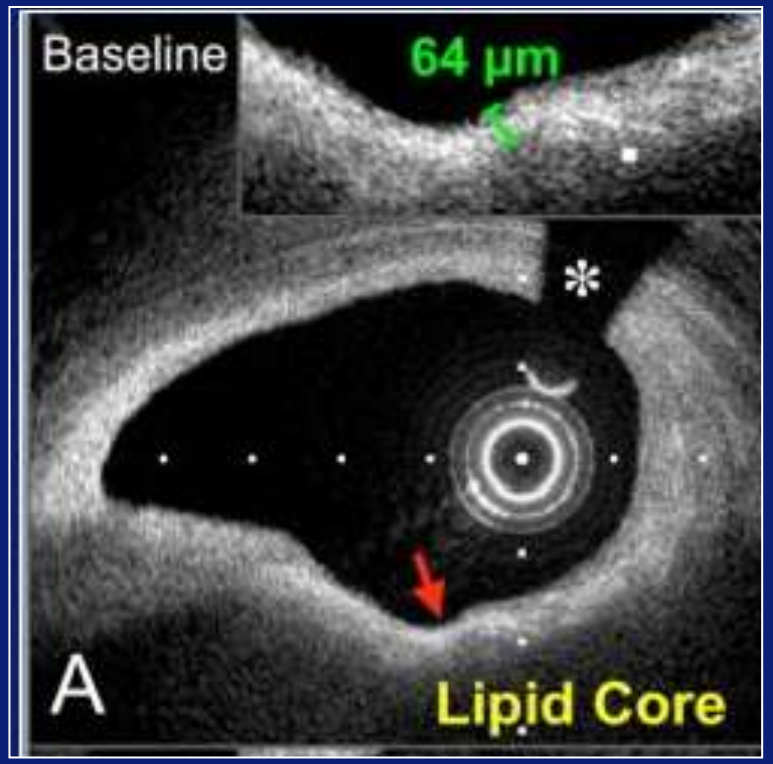
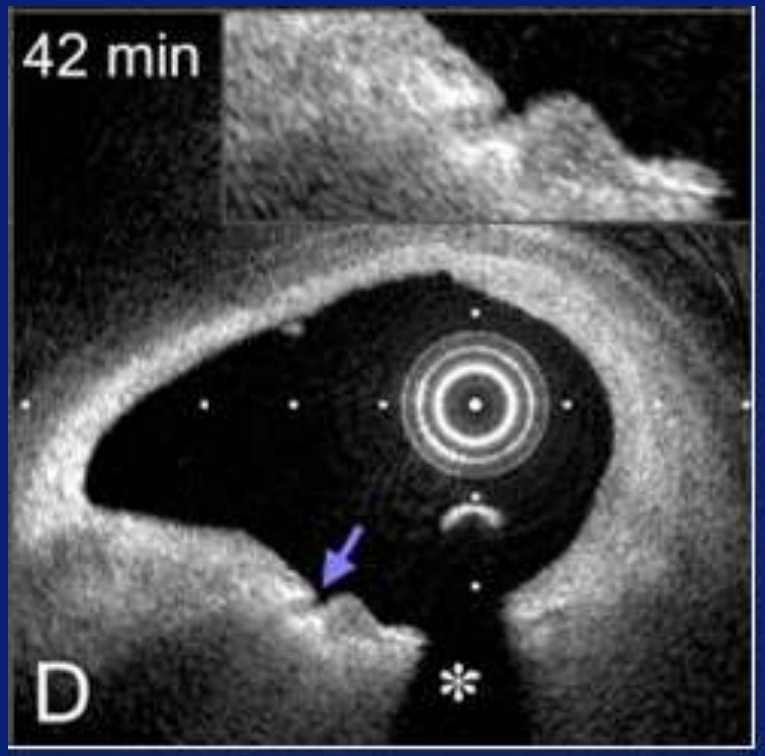




Gonzalo N et al. JACC Imaging. 2011

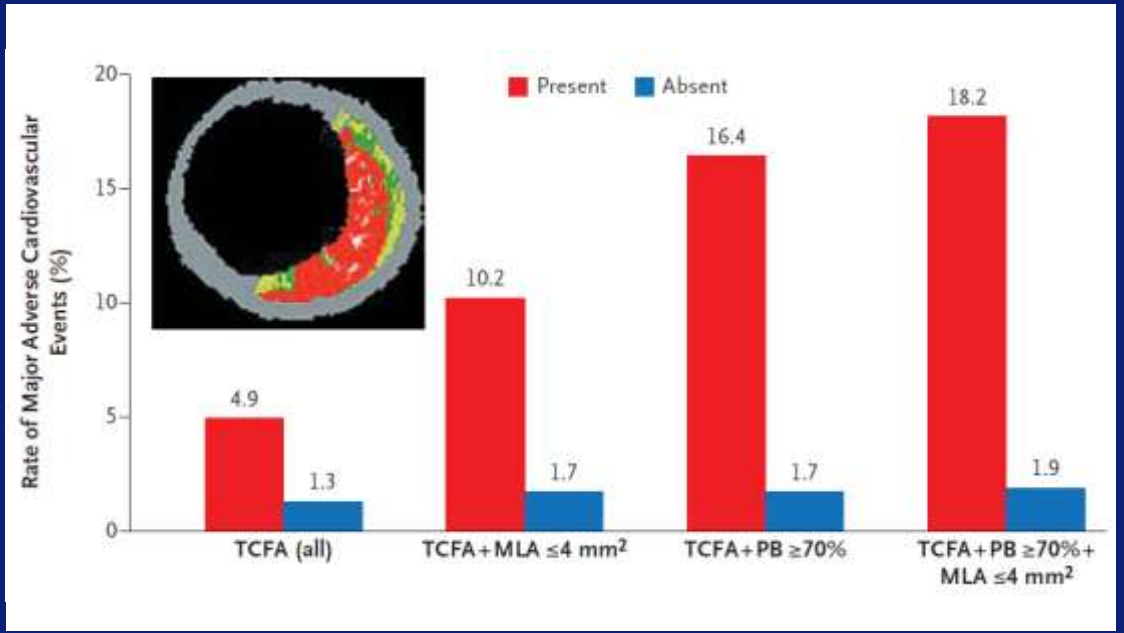
The TRUTH of treating CAD

PROSPECT study

FACT #8: Non-culprit vulnerable plaques have poor outcome

Non-culprit lesions in pts with ACS have increased risk of events:

- VH-TCFA morphology
- Plaque burden > 70%
- MLA < 4.0mm



Stone et al. N Eng J Med 2011

The TRUTH of treating CAD

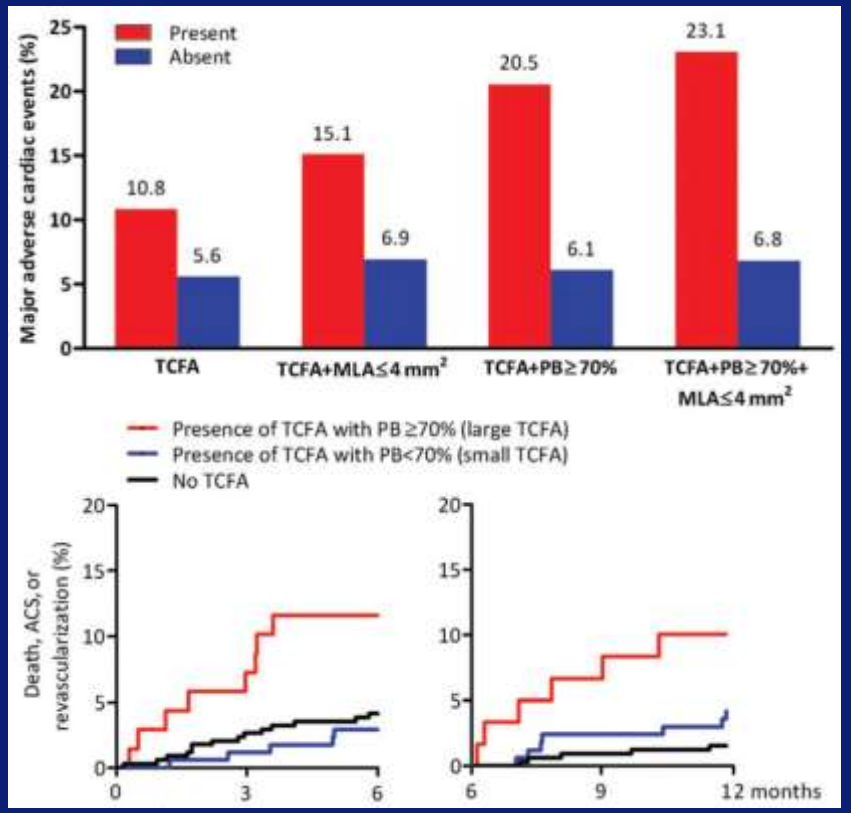
ATHEROREMO study

FACT #8: Non-culprit vulnerable plaques have poor outcome

Non-culprit lesions in pts with ACS and stable angina have increased risk of events:

- VH-TCFA morphology
- Plaque burden > 70%

VH-TCFA morphology was the only independent predictor of hard events.



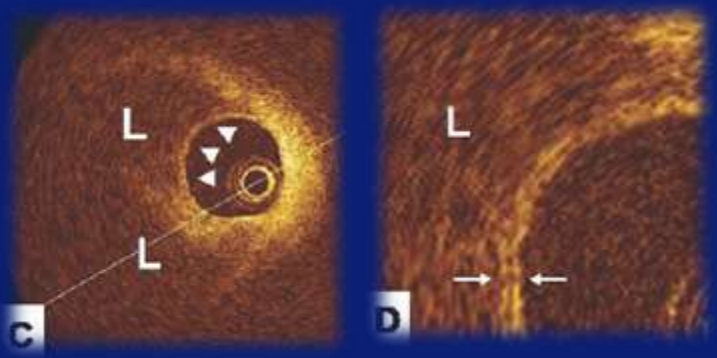
Cheng et al. Eur Heart J 2014

The TRUTH of treating CAD

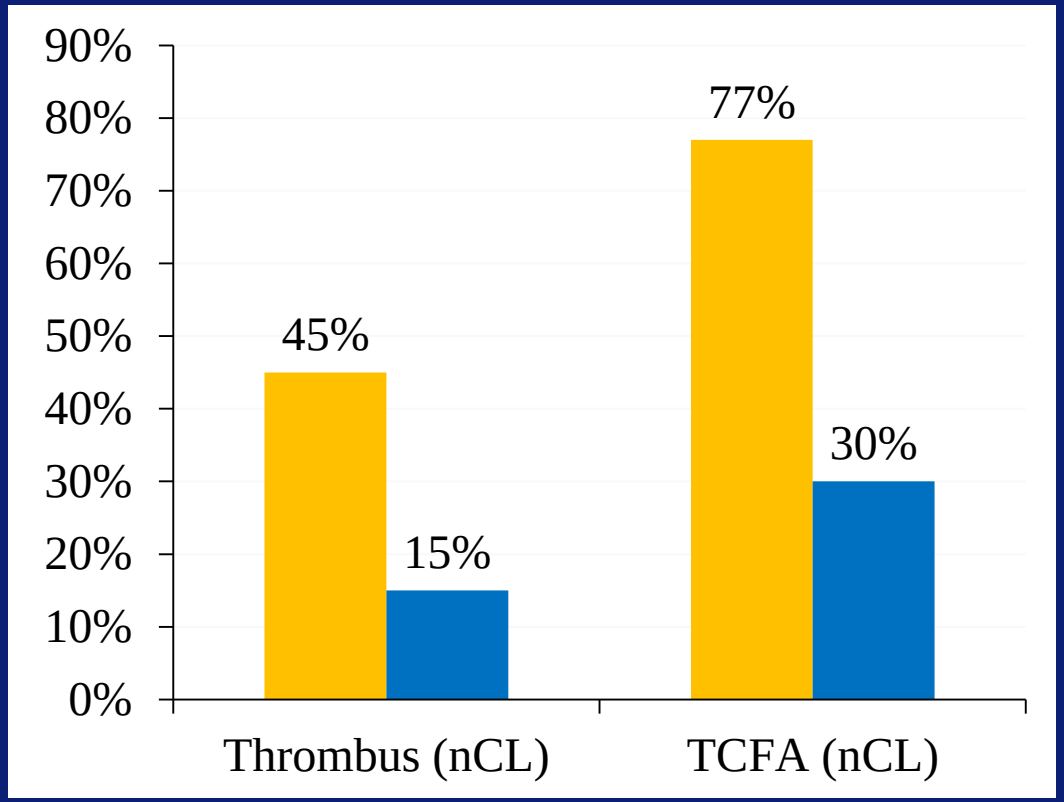
Insights from in vivo imaging

FACT #9: Non-culprit lesions of ACS have unstable morphology

Patients with AMI present more often with thrombus and TCFA in the non-culprit lesion



TCFA in non-culprit lesion of AMI



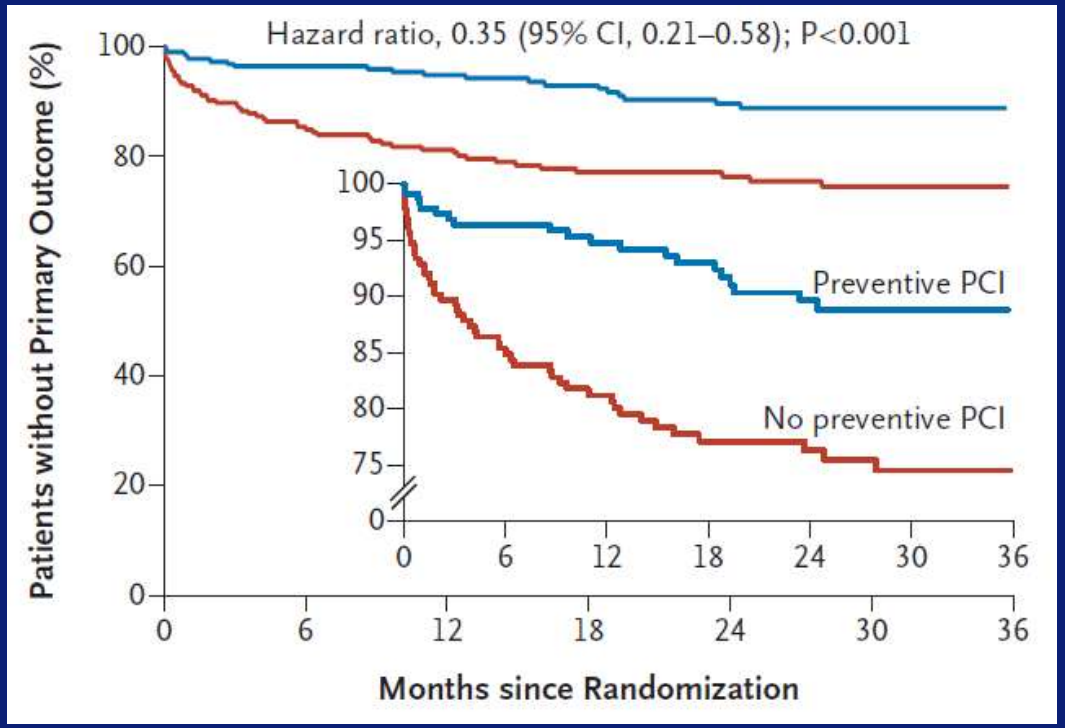
Fujii et al, J Am Coll Cardiol 2008

The TRUTH of treating CAD

PRAMI study

FACT #10: Treatment of non-culprit lesions of MI could potentially improve prognosis!

In patients with STEMI and multivessel coronary disease, PCI of non-culprit reduced primary outcome, but also hard events



Wald et al. N Eng J Med 2013

The TRUTH of treating CAD

PRAMI study

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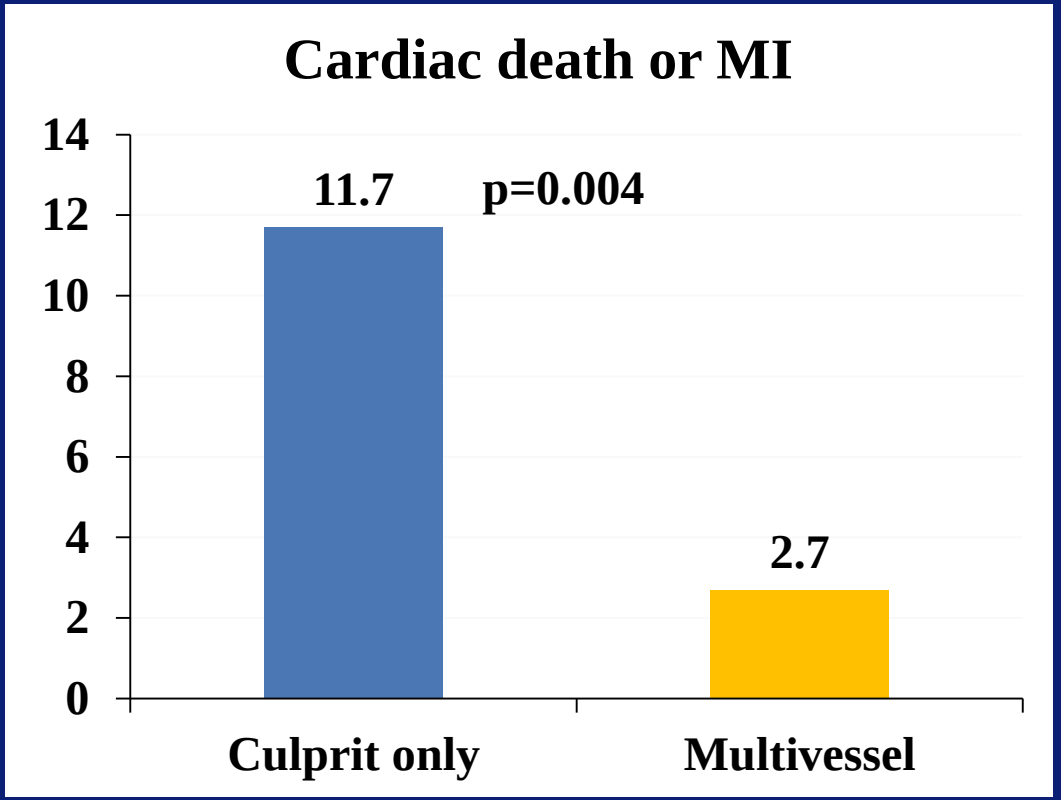

Wald et al. N Eng J Med 2013

For vulnerable plaque:
Detect and Treat It Prophylactically!

- Treatment of ischemia can improve symptoms, but improvement of prognosis is unclear
- Lesions producing ischemia are different from those causing ACS (vulnerable plaque)
- Vulnerable plaque can be identified in vivo, associated with adverse outcome
- Prophylactic PCI of vulnerable plaque could improve outcome, more studies needed

Even the best things are not equal to their FAME.
Henry David Thoreau

Thank you for your attention!

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