Defining Plaque Composition by CTA: The Latest Tool to Monitor Therapy?

John McB. Hodgson, M.D., FSCAI
Chairman, Department of Cardiology
Geisinger Health System
Wilkes Barre, Pa

GEISINGER

Disclosure Information

John McB. Hodgson MD, FSCAI

The following relationships exist related to this presentation:

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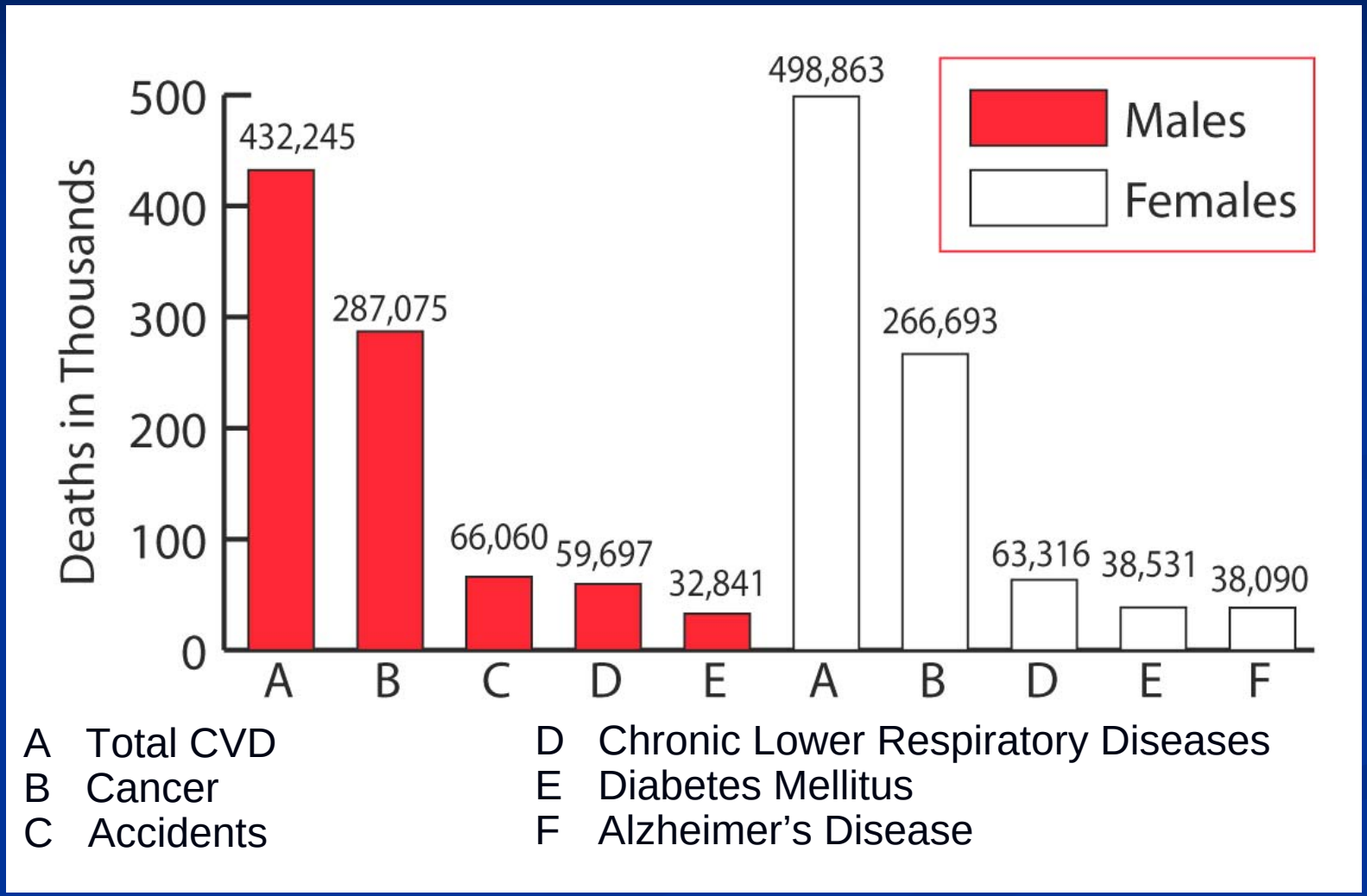
Volcano : C
Technology Solutions Group: EI
Boston Scientific, Pfizer, GE Medical : SB

Off label use of products will be discussed in this presentation.

Leading Causes of Death for All Males and Females

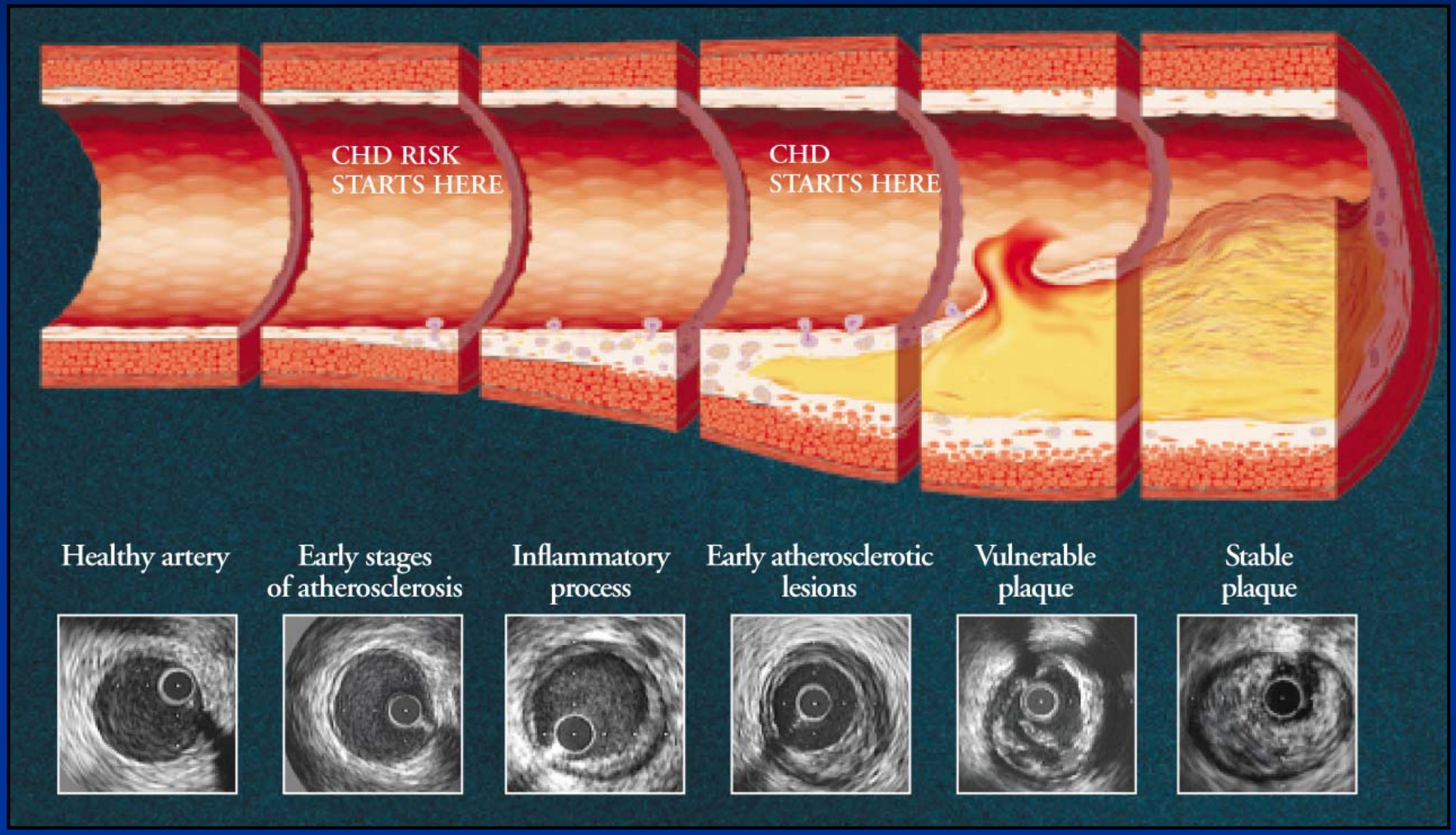
United States: 2001



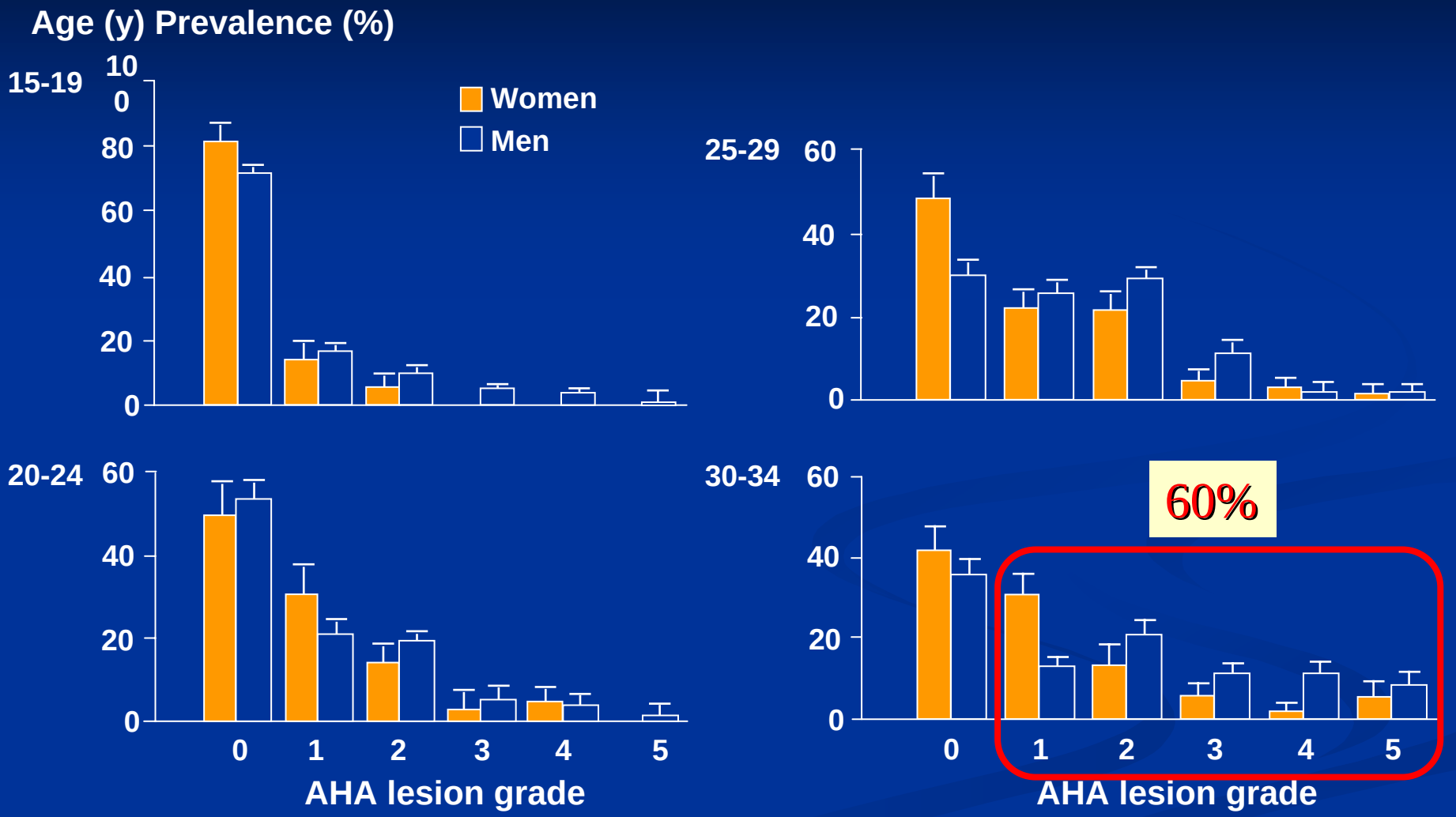
A Total CVD
B Cancer
C Accidents
D Chronic Lower Respiratory Diseases
E Diabetes Mellitus
F Alzheimer's Disease

Source: CDC/NCHS.

Progression of atherosclerosis



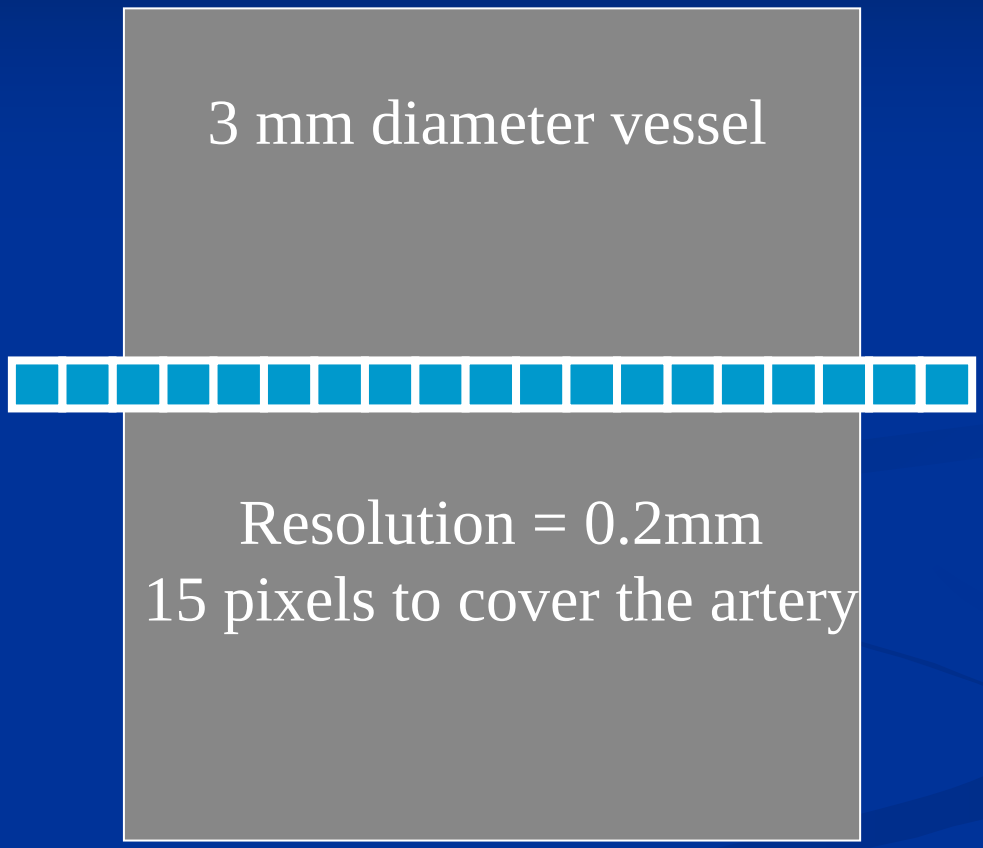
PDAY: Prevalence of Lesions in LAD



Error bar=SE.

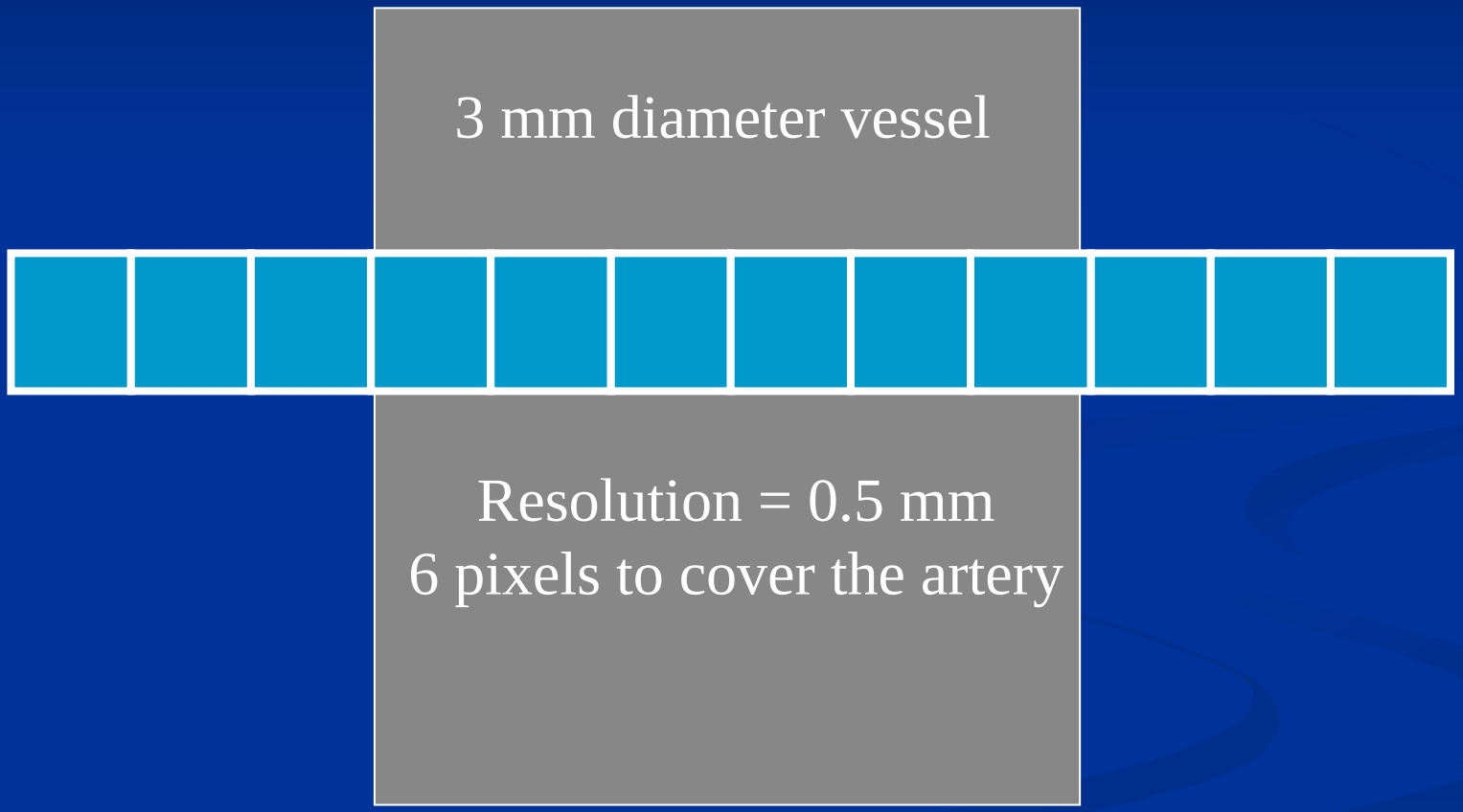
McGill HC Jr, et al. *Circulation.* 2000;102:374-379.

Resolution @ 512 display



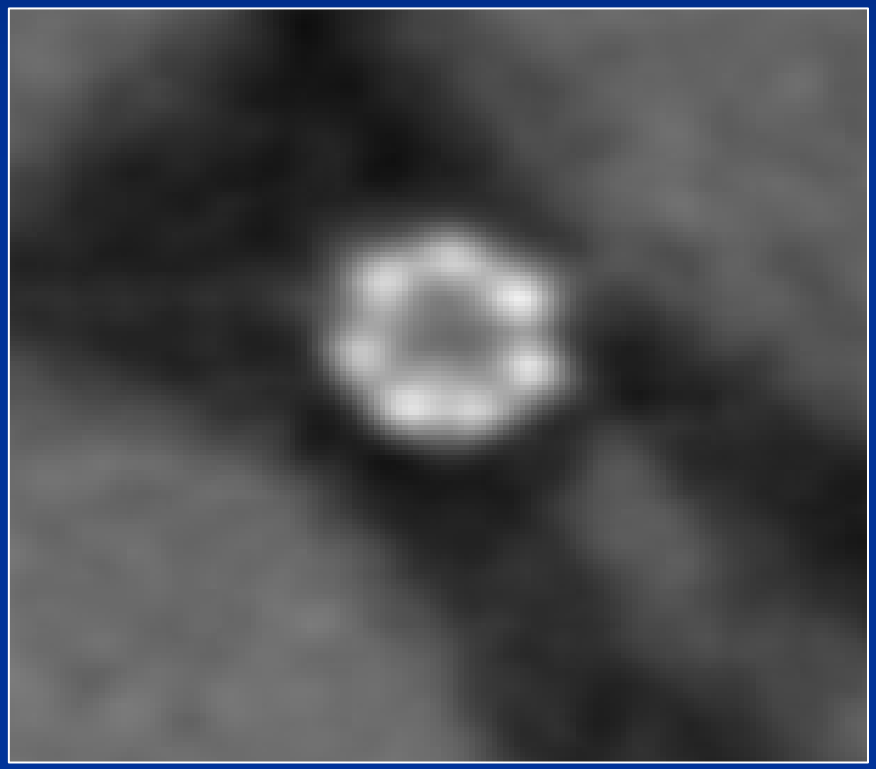
Quantitative Coronary Angiography

Resolution @ 512 display

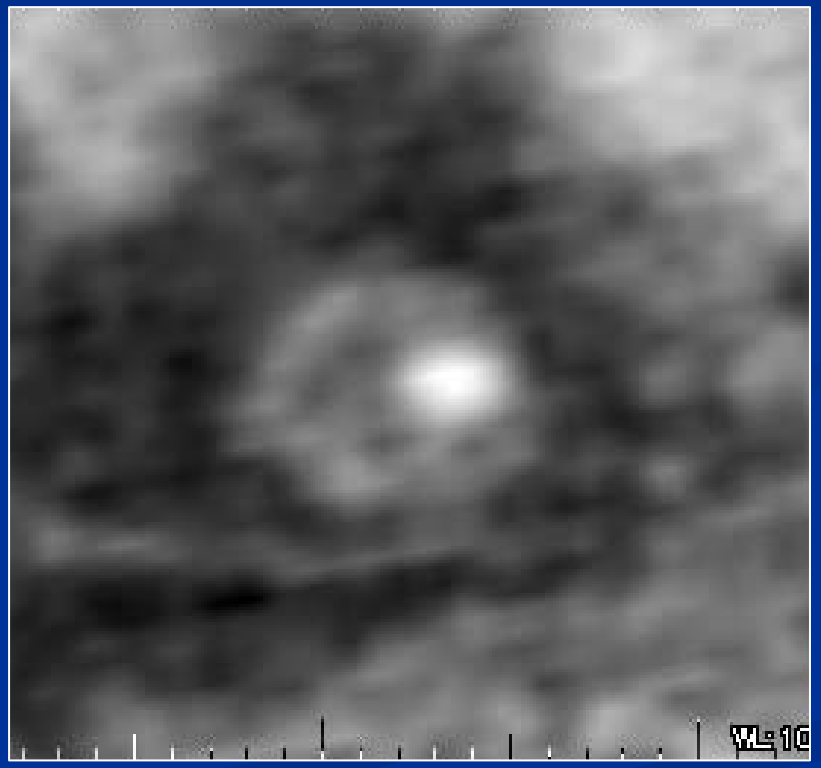


Coronary CT Angiography

Detailed coronary anatomy

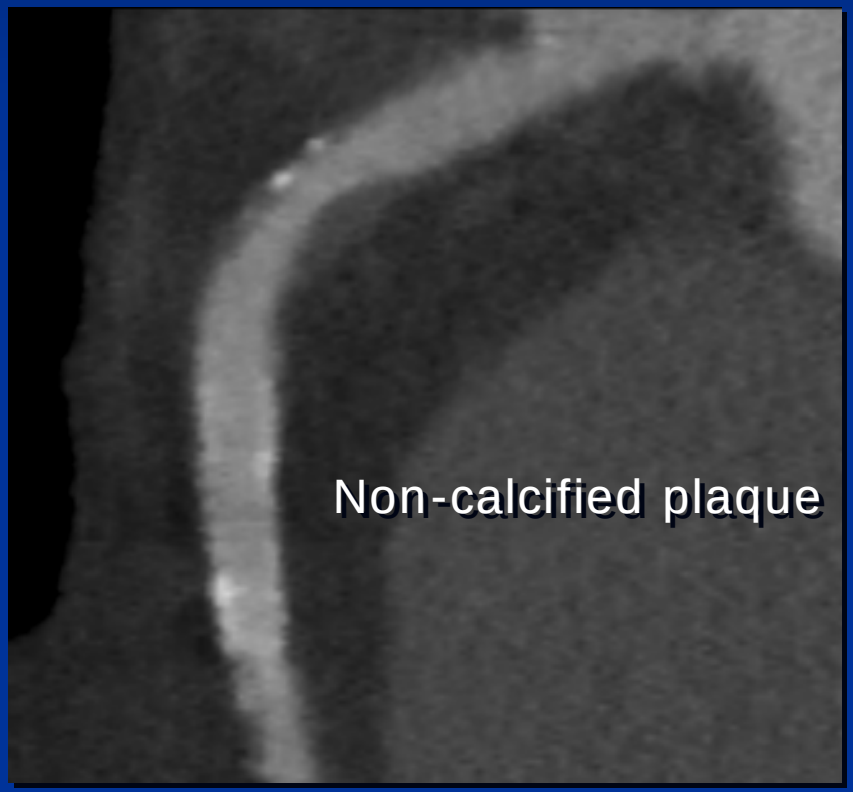


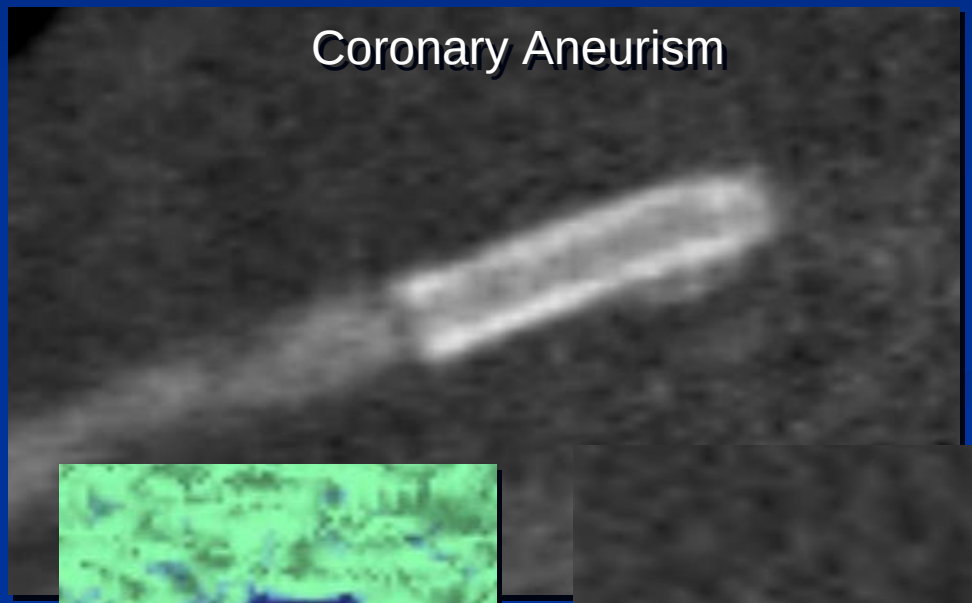
Stent 2 mm

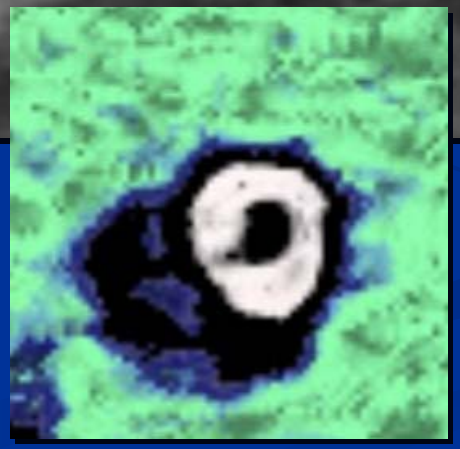


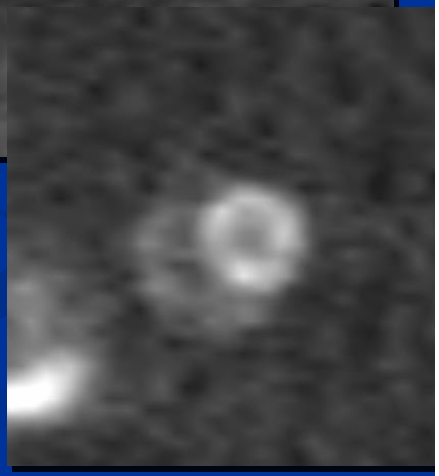
Non-calcified Plaque

High resolution coronary CTA



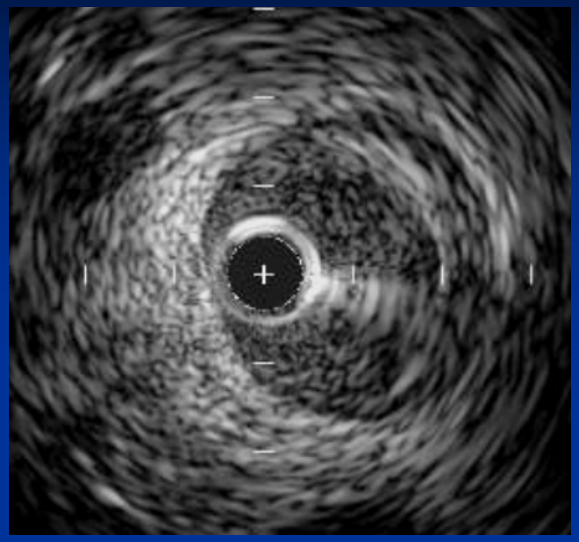




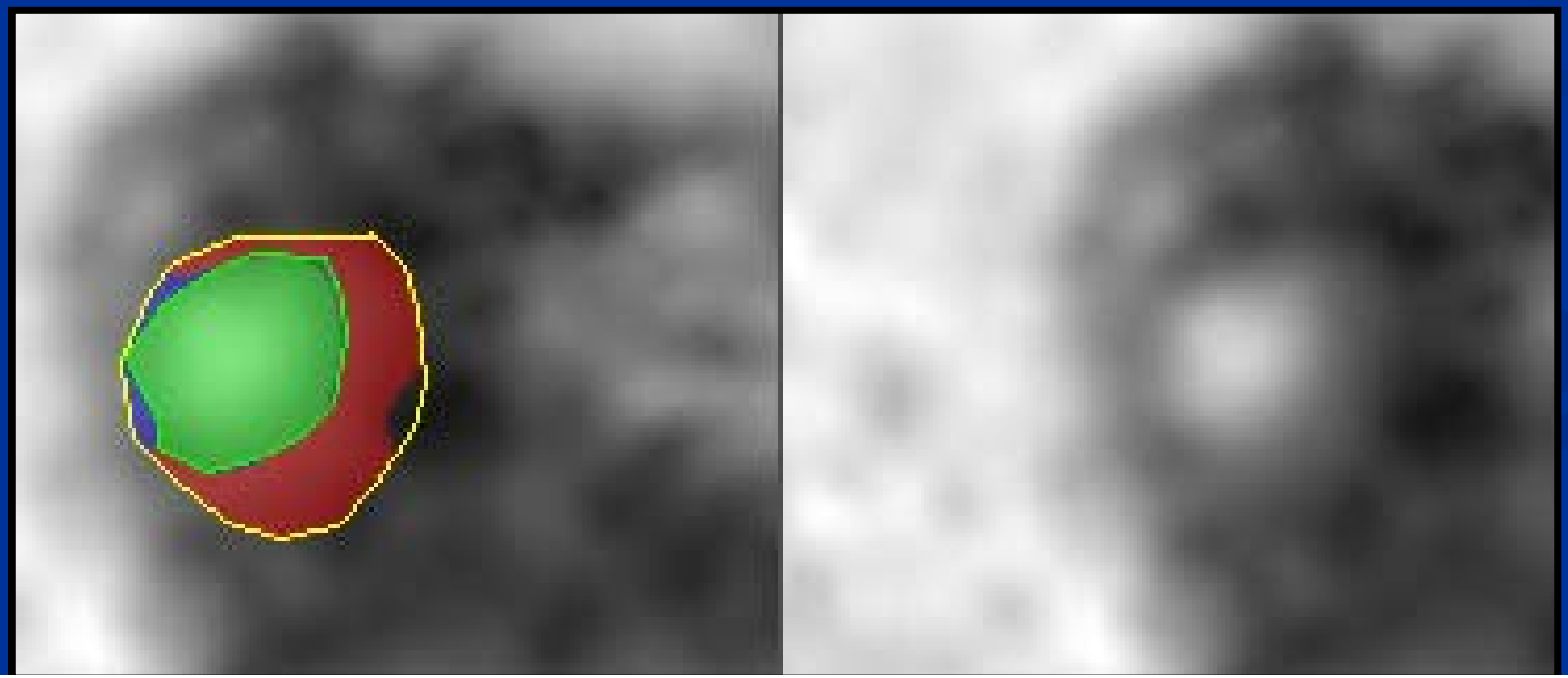


Courtesy, GE Medical

Noncalcified Plaque: CTA vs. IVUS

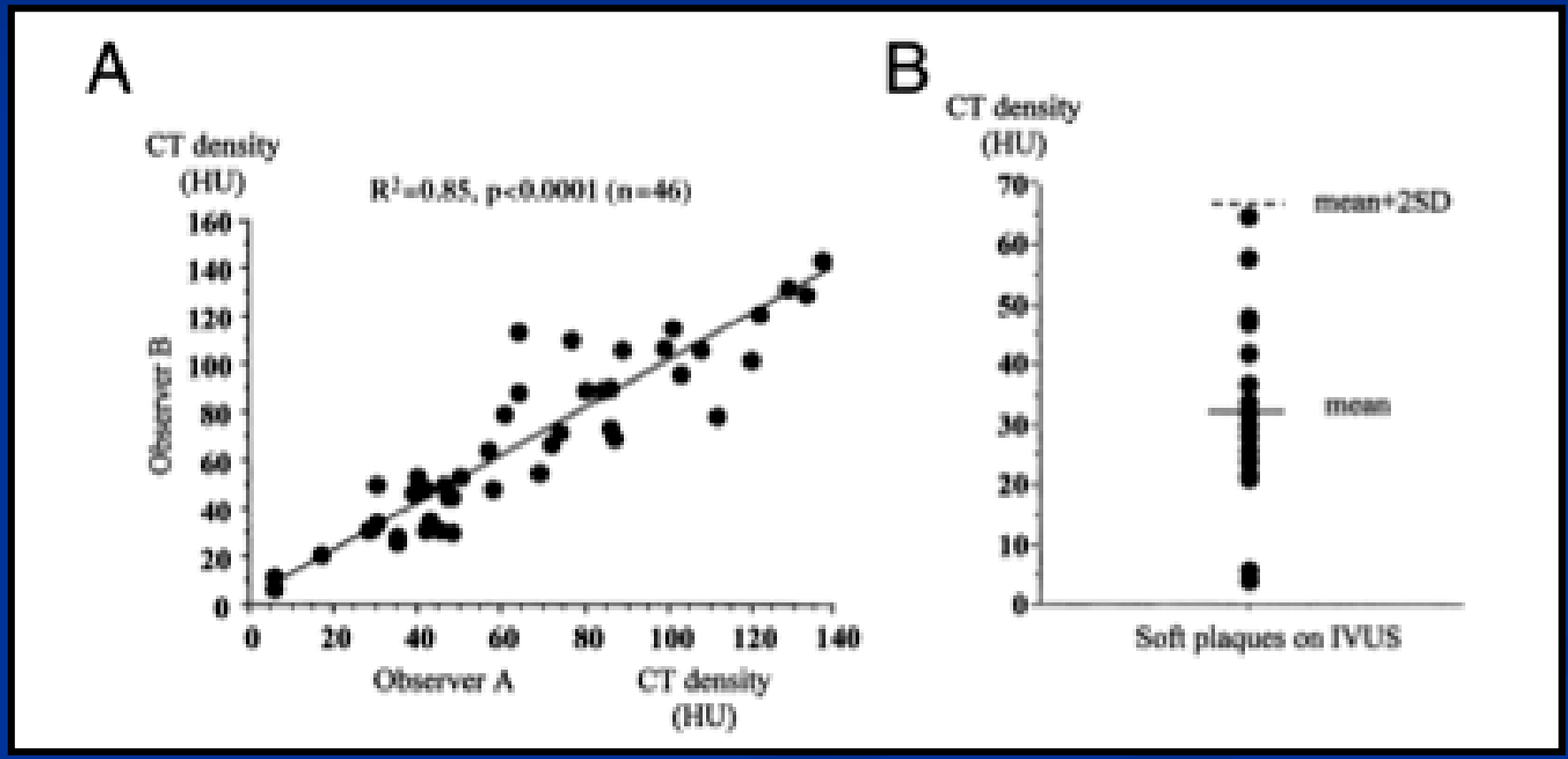


Hounsfield units (HU)



CCTA for plaque characterization

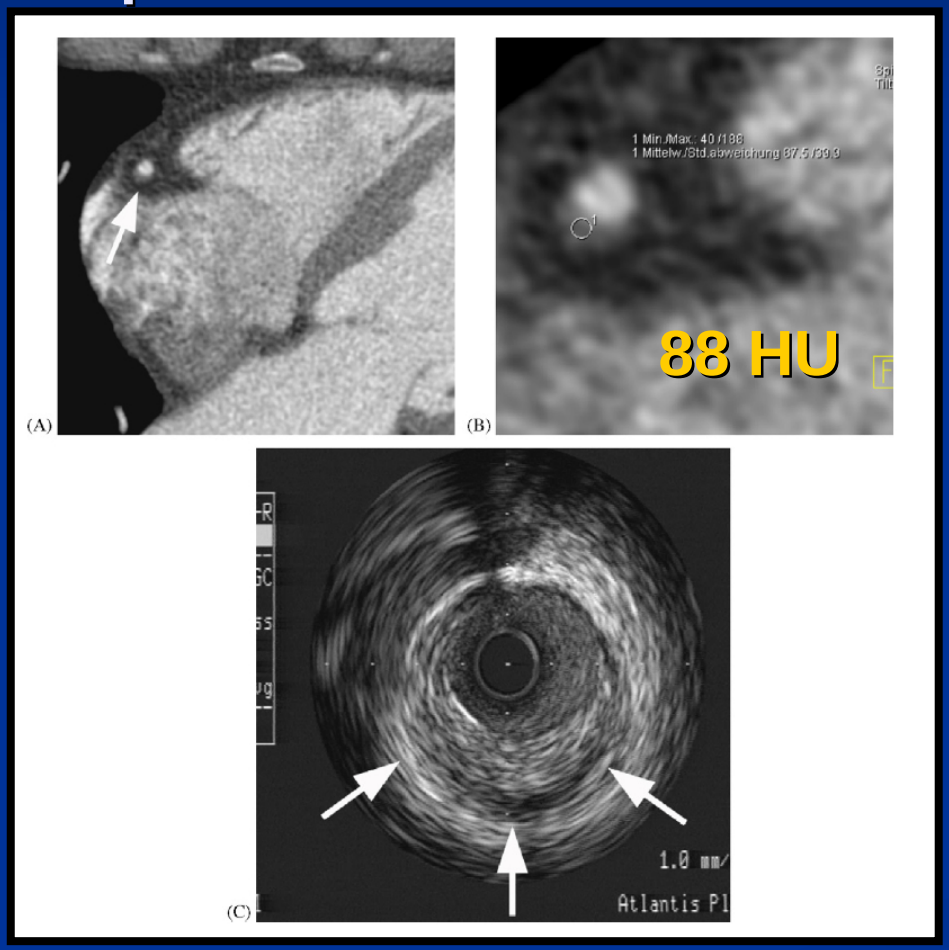
N=21 ACS, 53 stable pts; non-culprit lesions; 16 slice

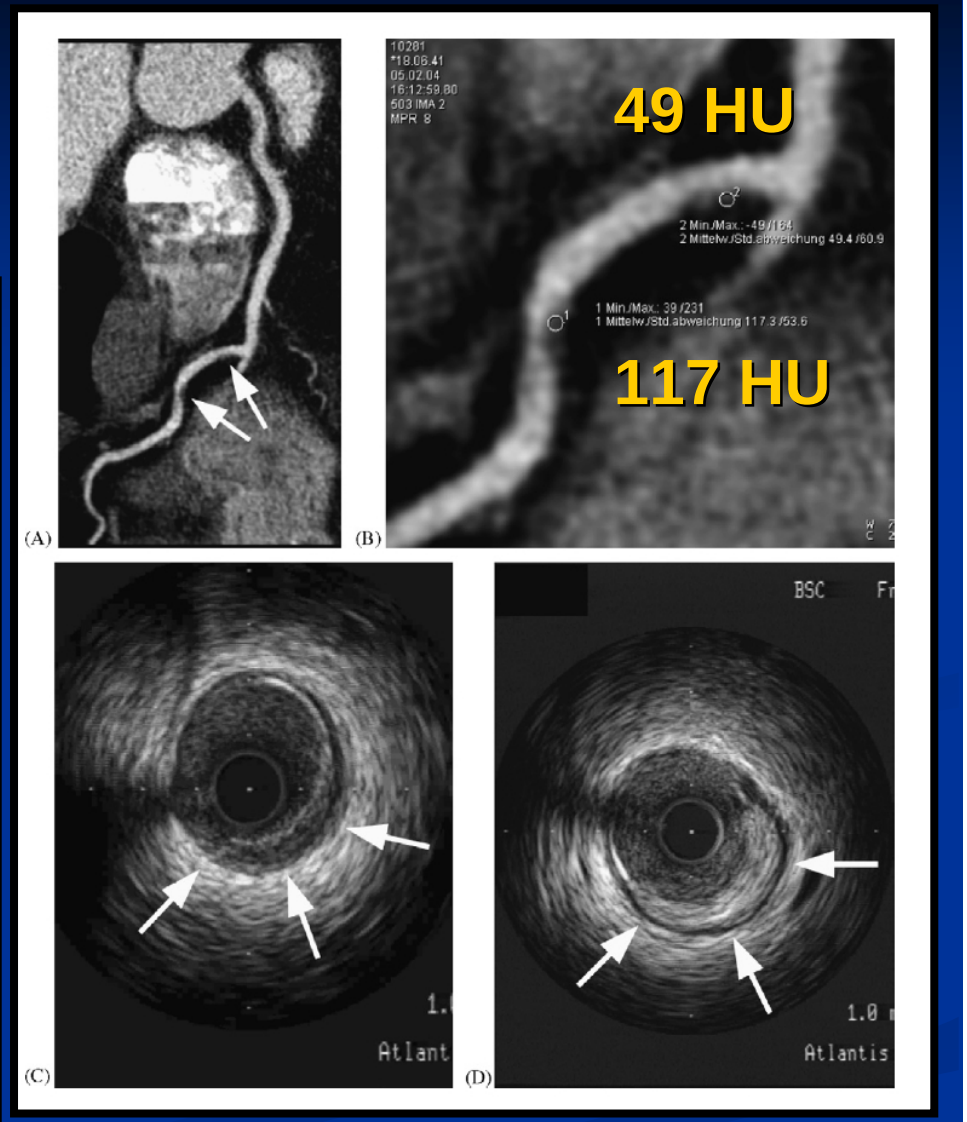


Kunimasa, et al Circ J 2005;69:1346-51

IVUS-CTA

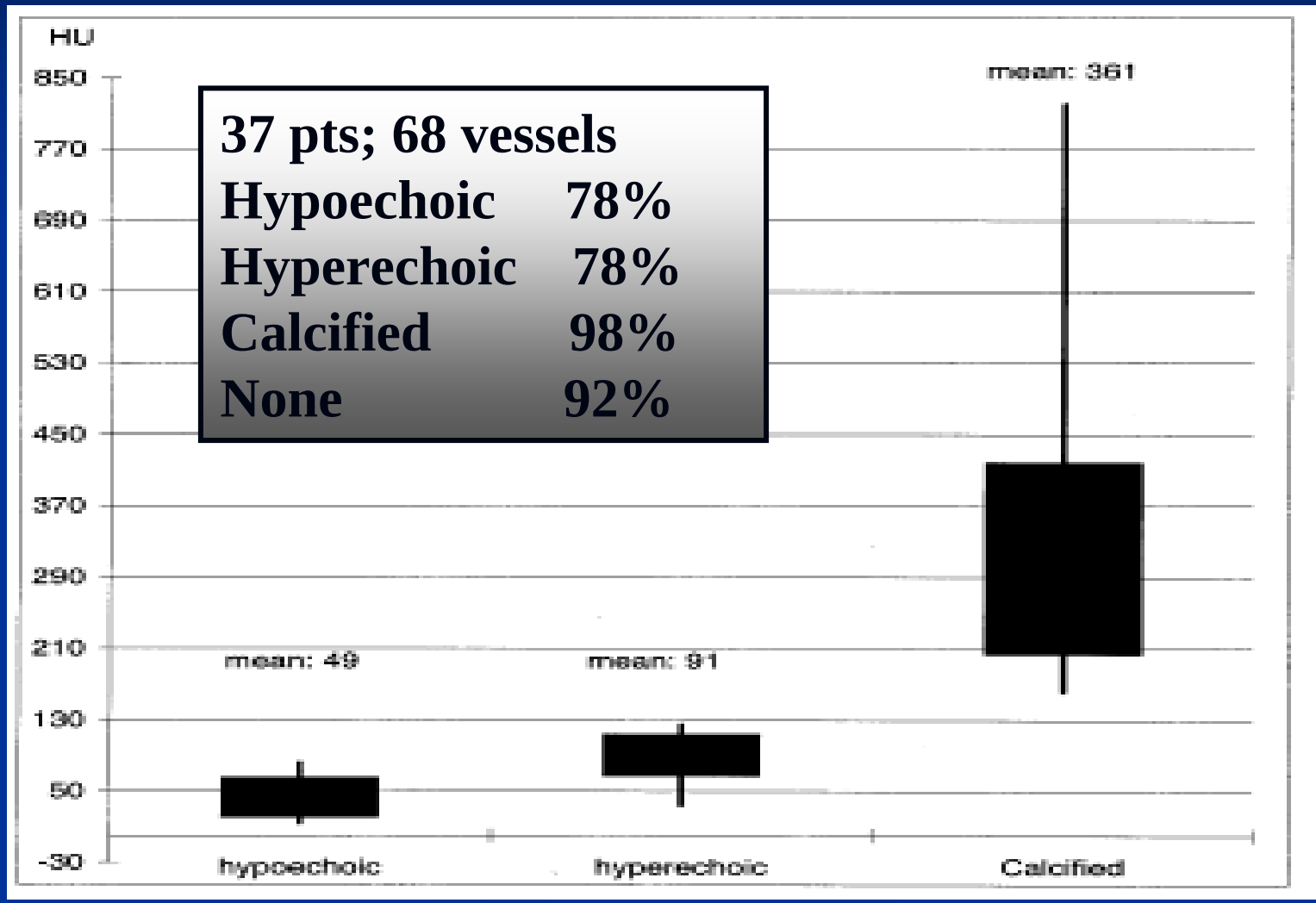
n=32 pt; 252 sites; 16 slice qualitative IVUS vs. HU



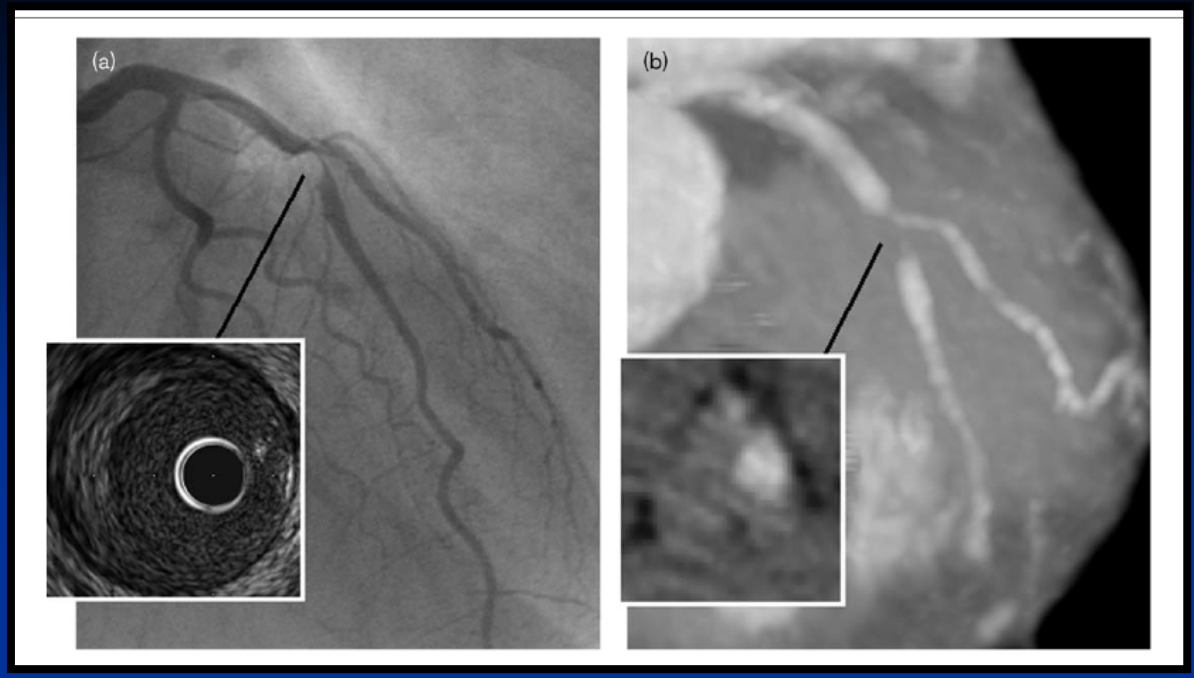


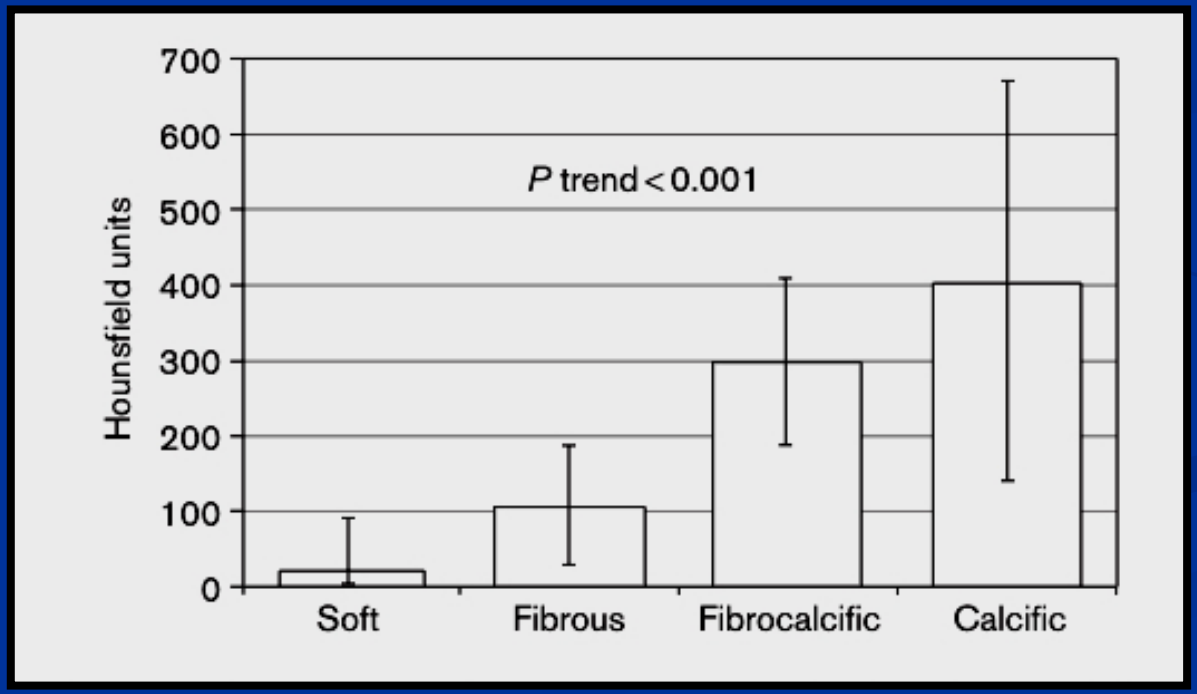
Pohle, et al Atherosclerosis 2007;190:174-180

Detection of Calcified and Noncalcified Plaque: 16 Slice CTA vs IVUS



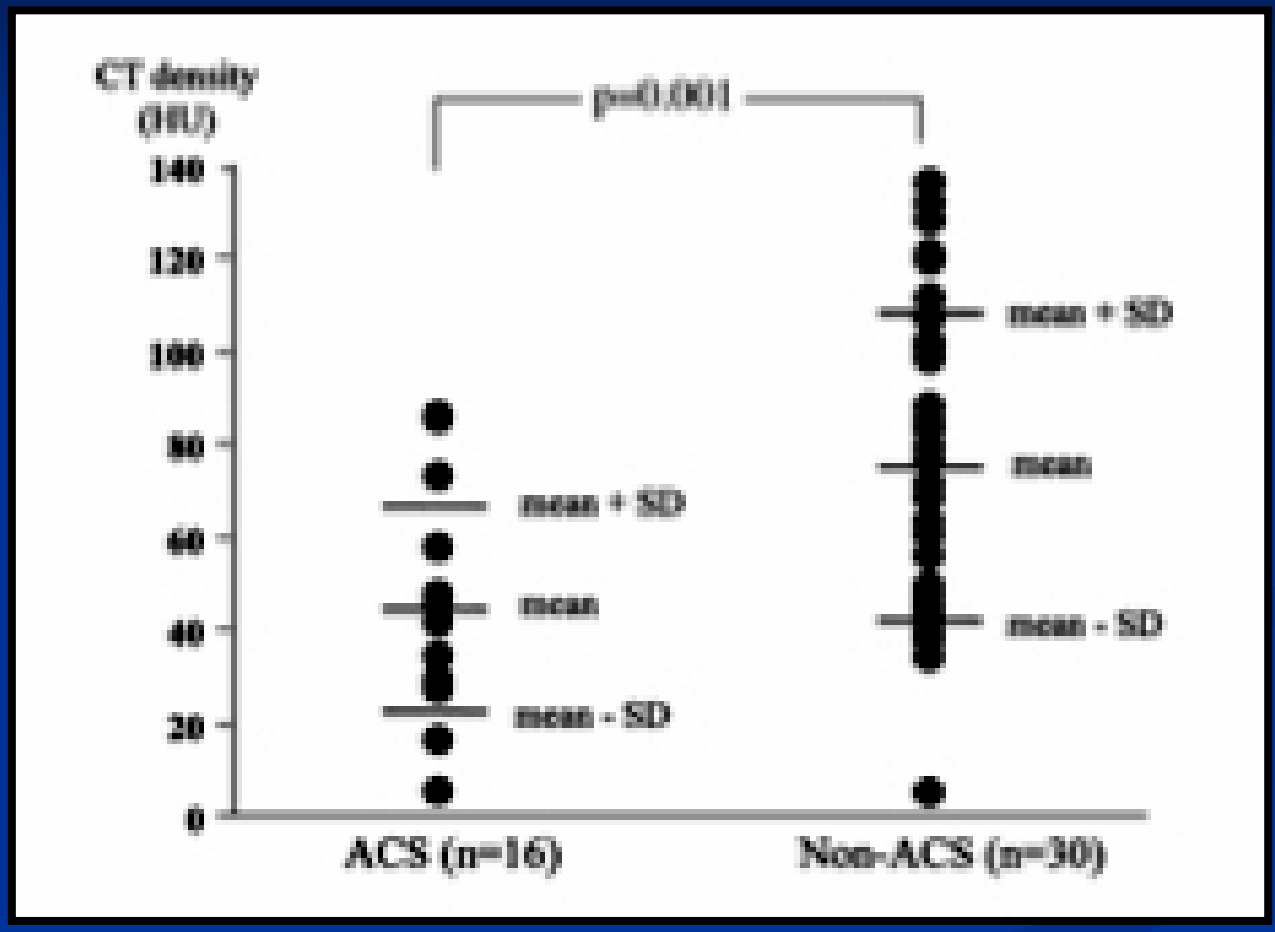
Leber et al. JACC;2004;43:1241–7





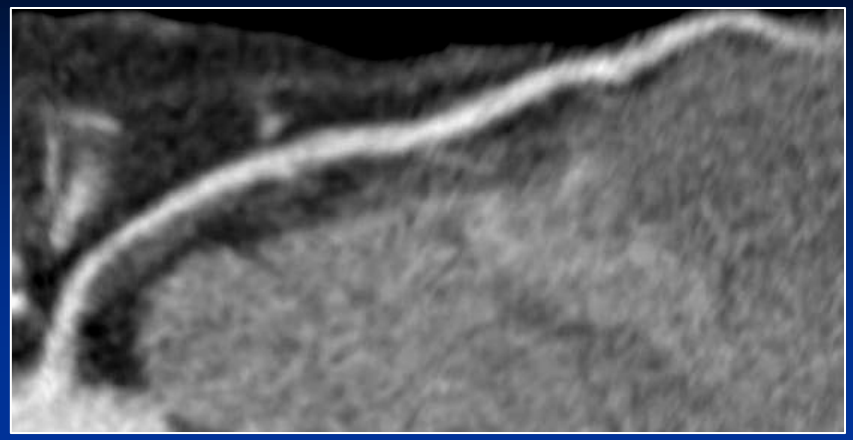
Rasouli, et al Coron Artery Dis 2006; 17:359-364

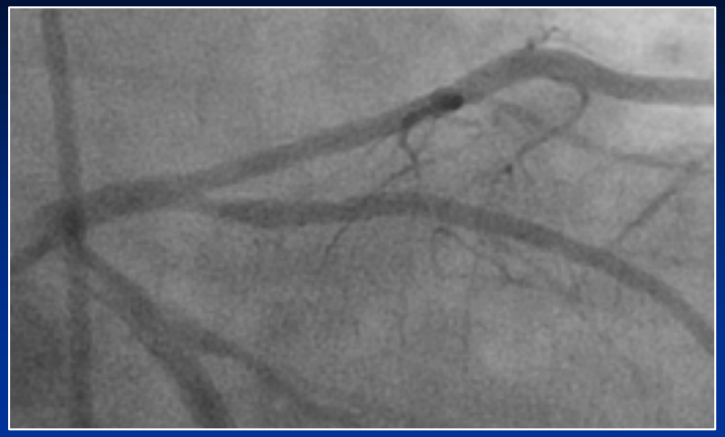
Detection of Vulnerable plaque

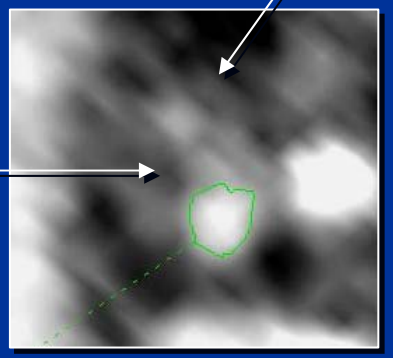


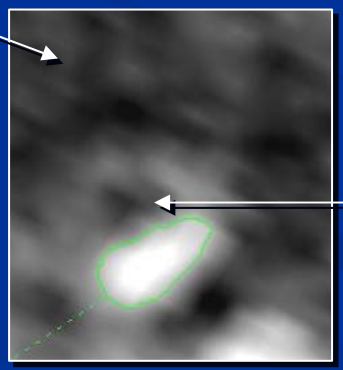
“low density” < 68 HU based on IVUS correlation

Kunimasa, et al Circ J 2005;69:1346-5









- 34

- 105

TCFA ?

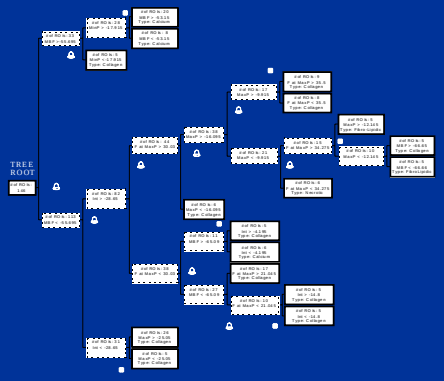
MLA 2.8 mm²

5.2 mm²

Courtesy: Harvey Hecht

VH-IVUS

Classification Tree



VH Legend

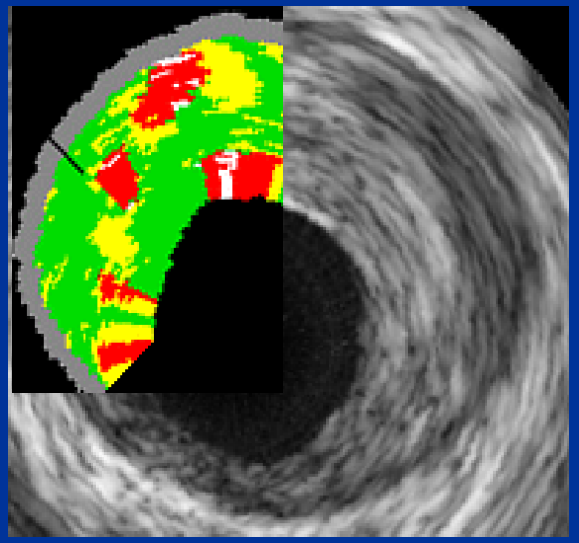
MEDIA

FIBROUS

FIBROLIPIDIC

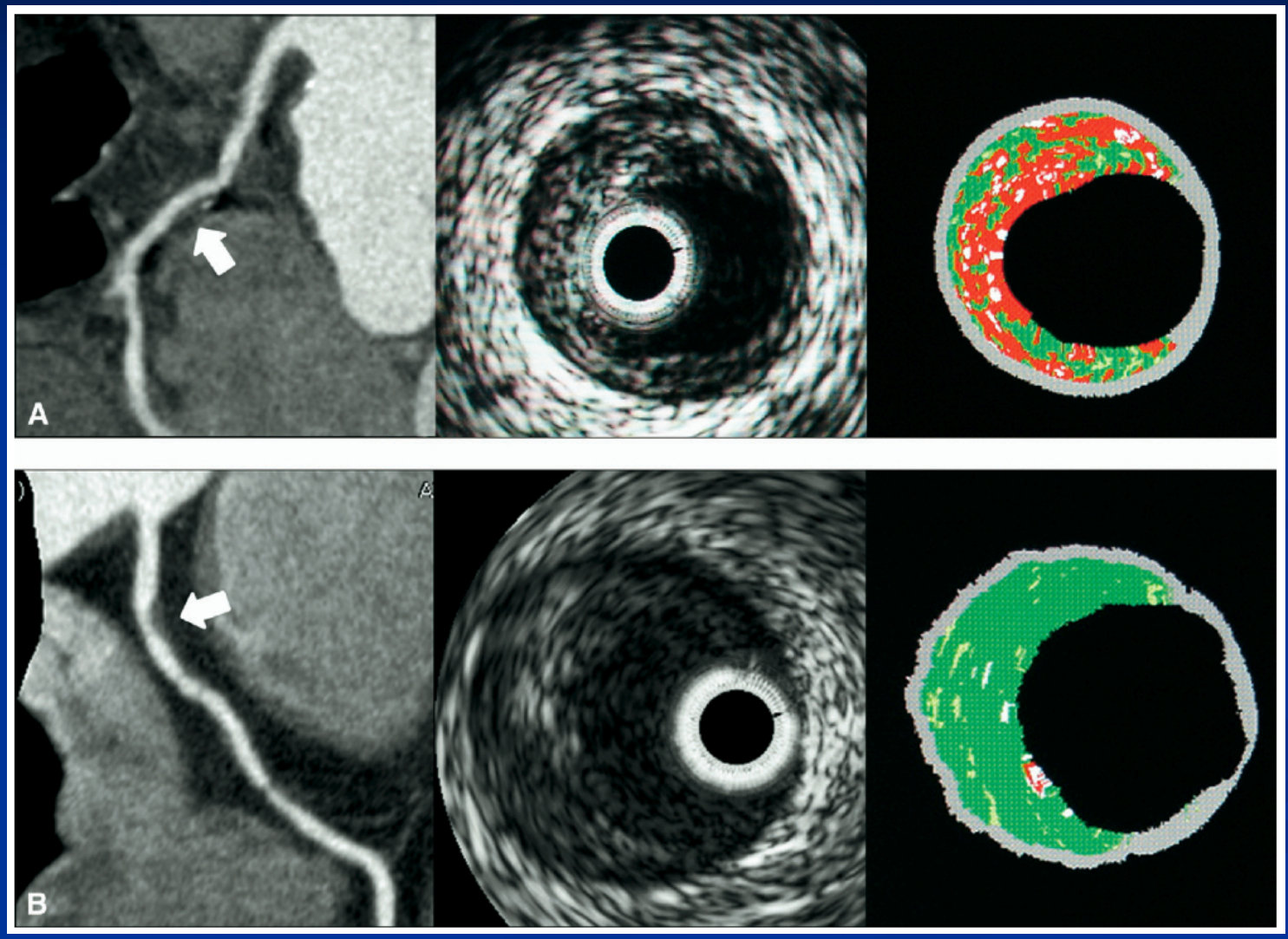
CALCIUM

NECROTIC CORE



John McB. Hodgson, M.D.

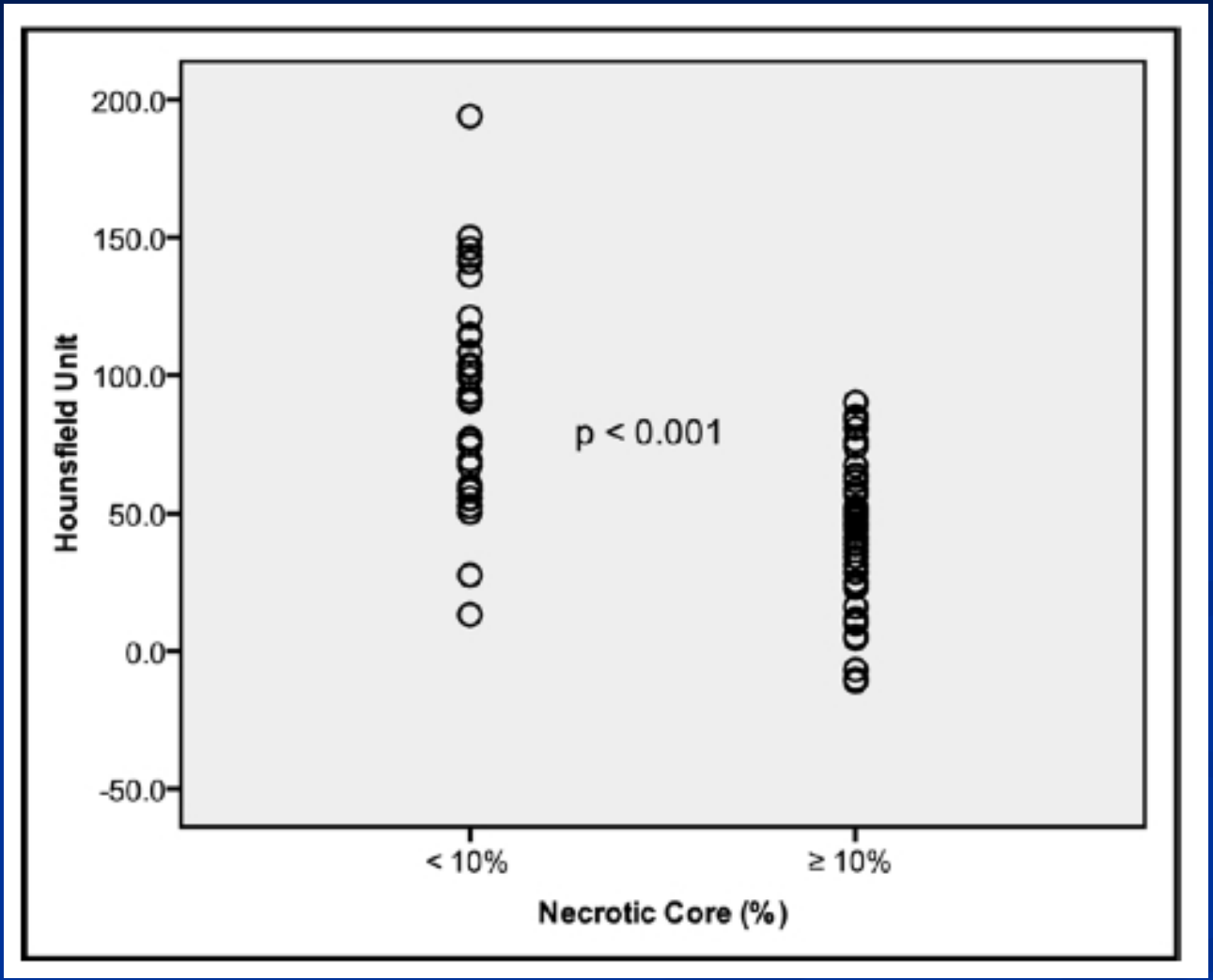
Correlation of CT and VH-IVUS



N=59 pts, 80 lesions

Am J Cardiol 2008;102:988-993

Correlation of CT and VH-IVUS



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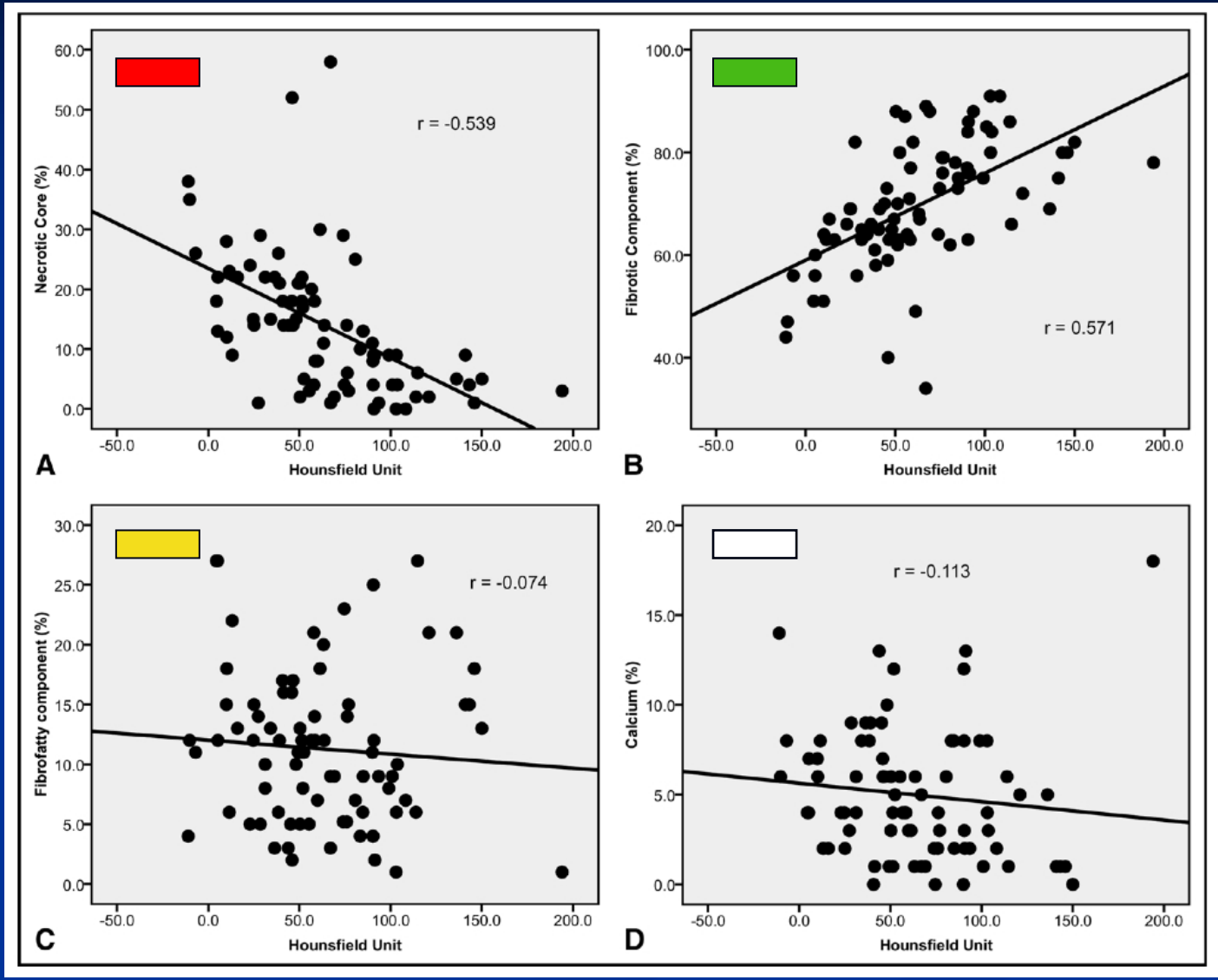


N=59 pts, 80 lesions

Am J Cardiol 2008;102:988-993

Plaque burden important

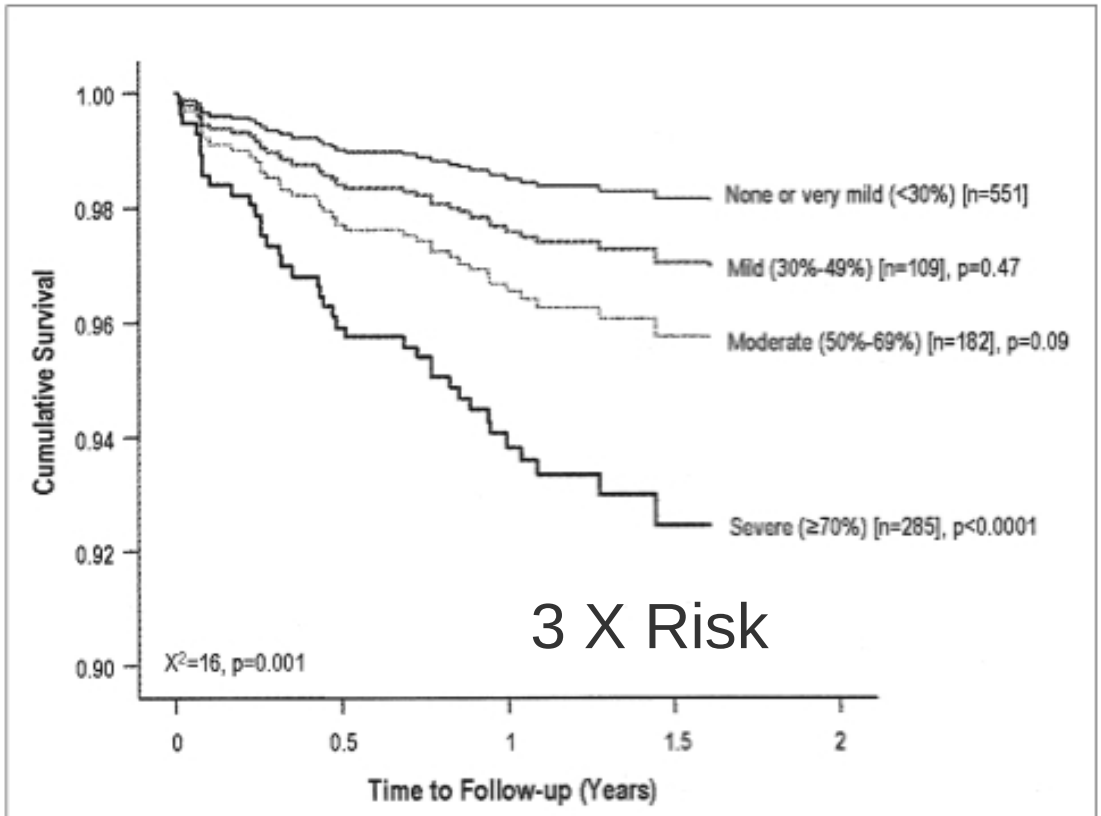


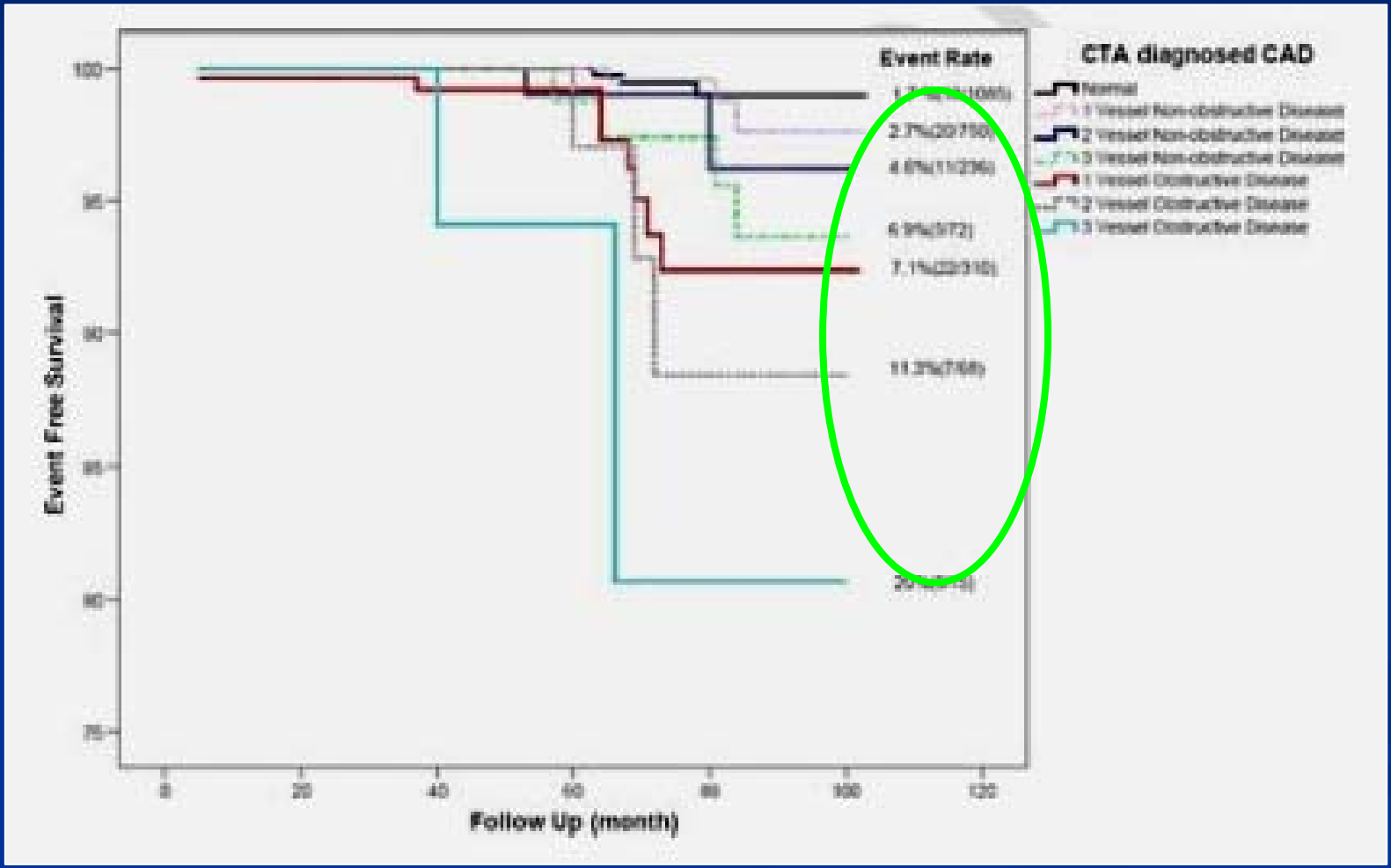
Figure 5 **Cumulative Survival in Patients With Proximal Left Anterior Descending Artery Plaque by CCTA**

Risk-adjusted p < 0.001 (controlling for age, family history, and dyslipidemia). CCTA = coronary computed tomographic angiography.

Min JACC 2007;50:1161

CTA and prognosis

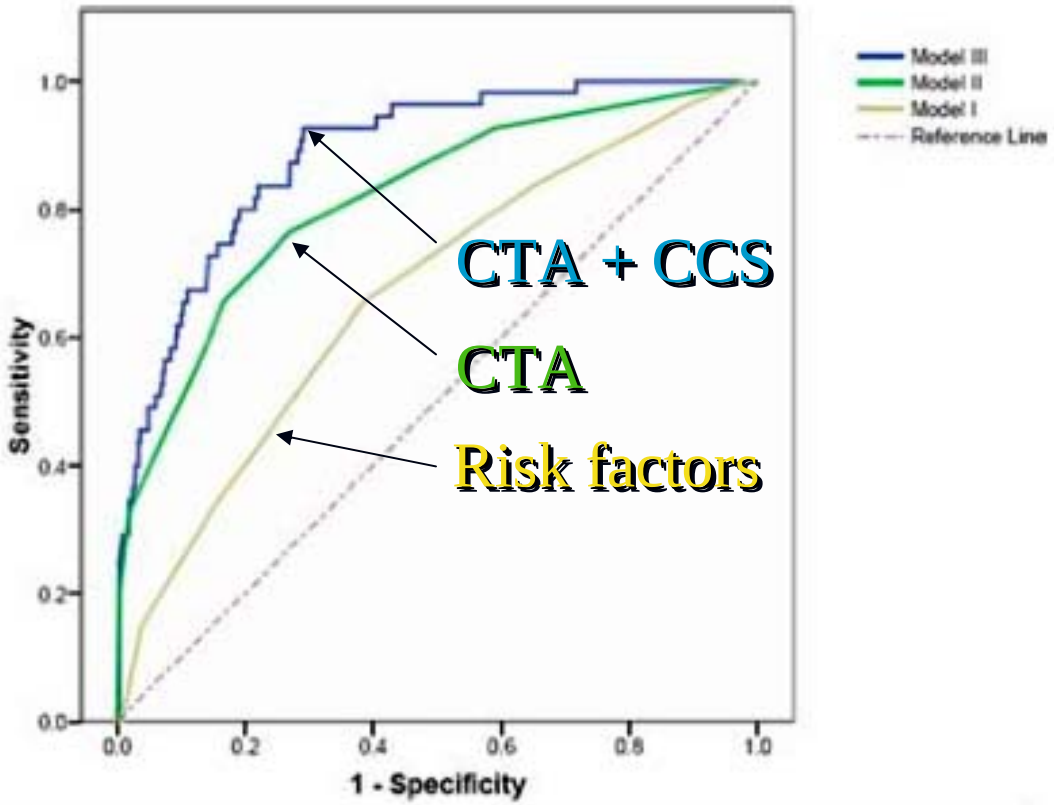
2538 pts; referred by MD; 15 year follow-up; all cause mortality



Use of EBCT

Ostrom JACC 2008; in press

CTA and prognosis



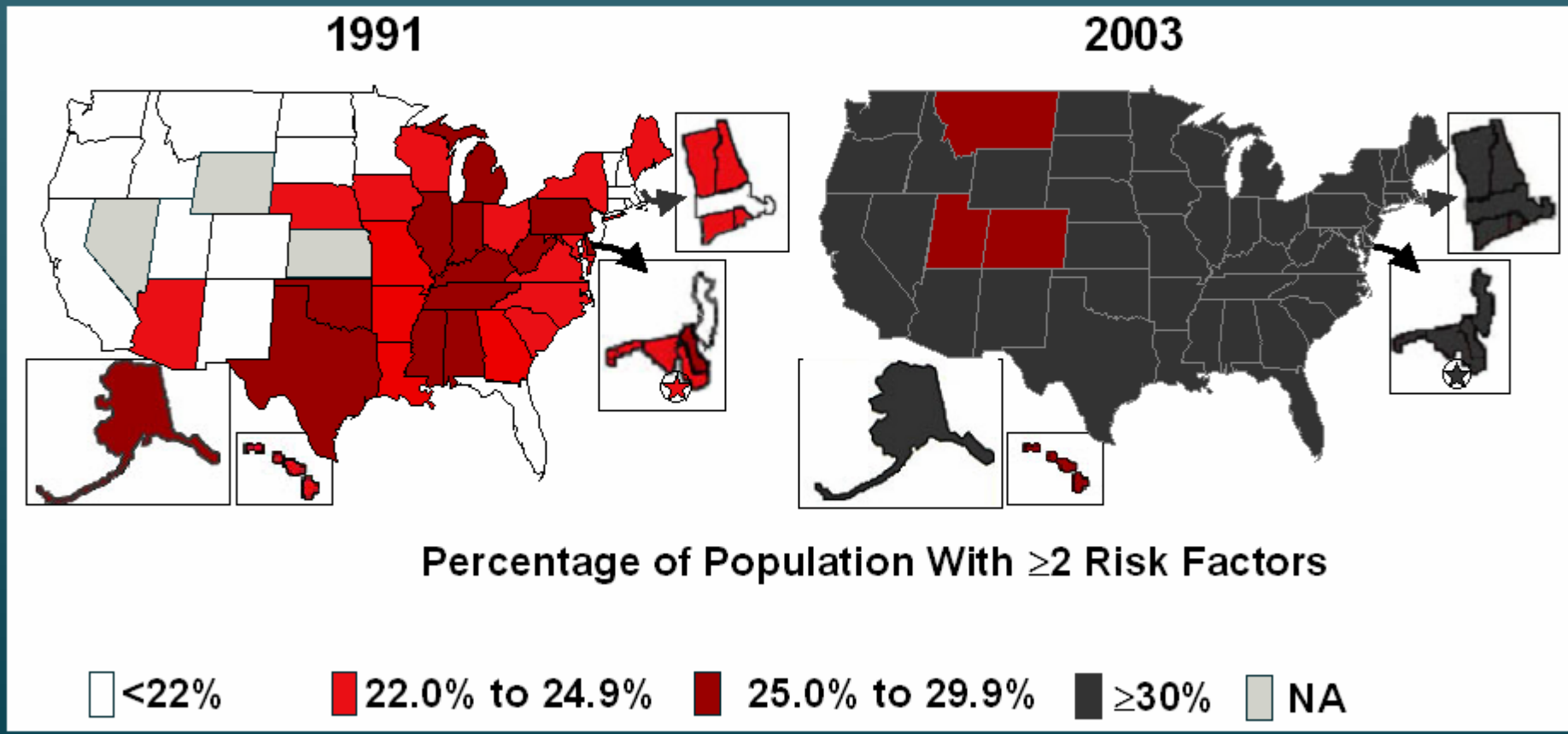
Model	AUC(±S.D.)	95% Confidence Interval	P
Model I	0.69 (0.04)	0.61-0.77	.0001
Model II	0.83 (0.03)	0.77-0.88	.0001
Model III	0.89 (0.01)	0.86-0.93	.0001

Model I: diabetes, hypertension, hypercholesterolemia, family history of premature CHD, smoking
Model II: CTA diagnosed CAD
Model III: CTA diagnosed CAD and CACS
*P<0.0001 in model II and III compared to model I

Ostrom JACC 2008; in press

Percentage of the US Population With ≥2 Risk Factors*

Risk Factors=High BP, High Cholesterol, Diabetes,† Obesity, Smoking

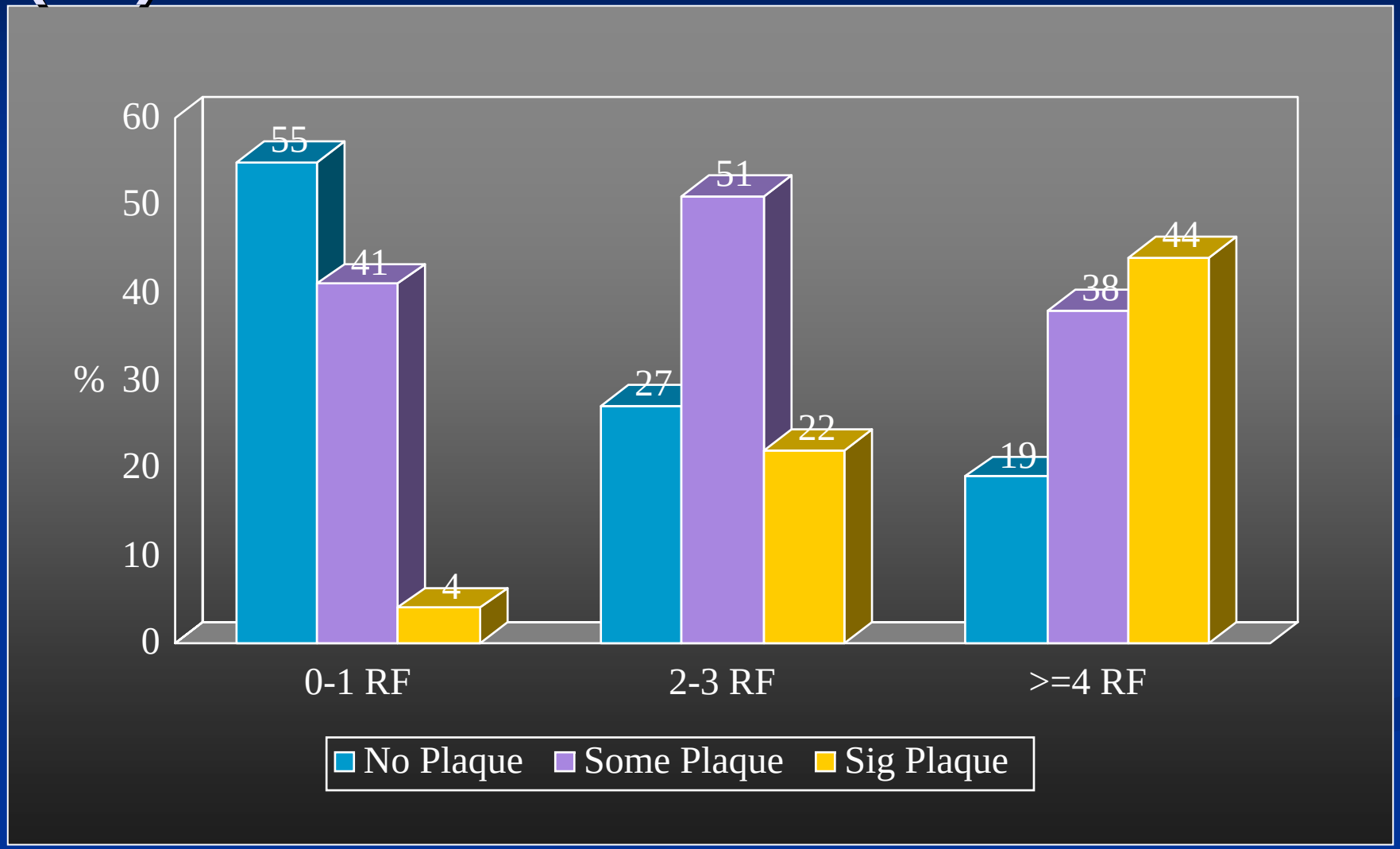


*Risk factors are self-reported. †Diabetes is a CHD risk equivalent.

Greenlund et al. *Arch Intern Med.* 2004;164:181-188.

CDC. *MMWR Morb Mortal Wkly Rep.* 2005;54:113-117.

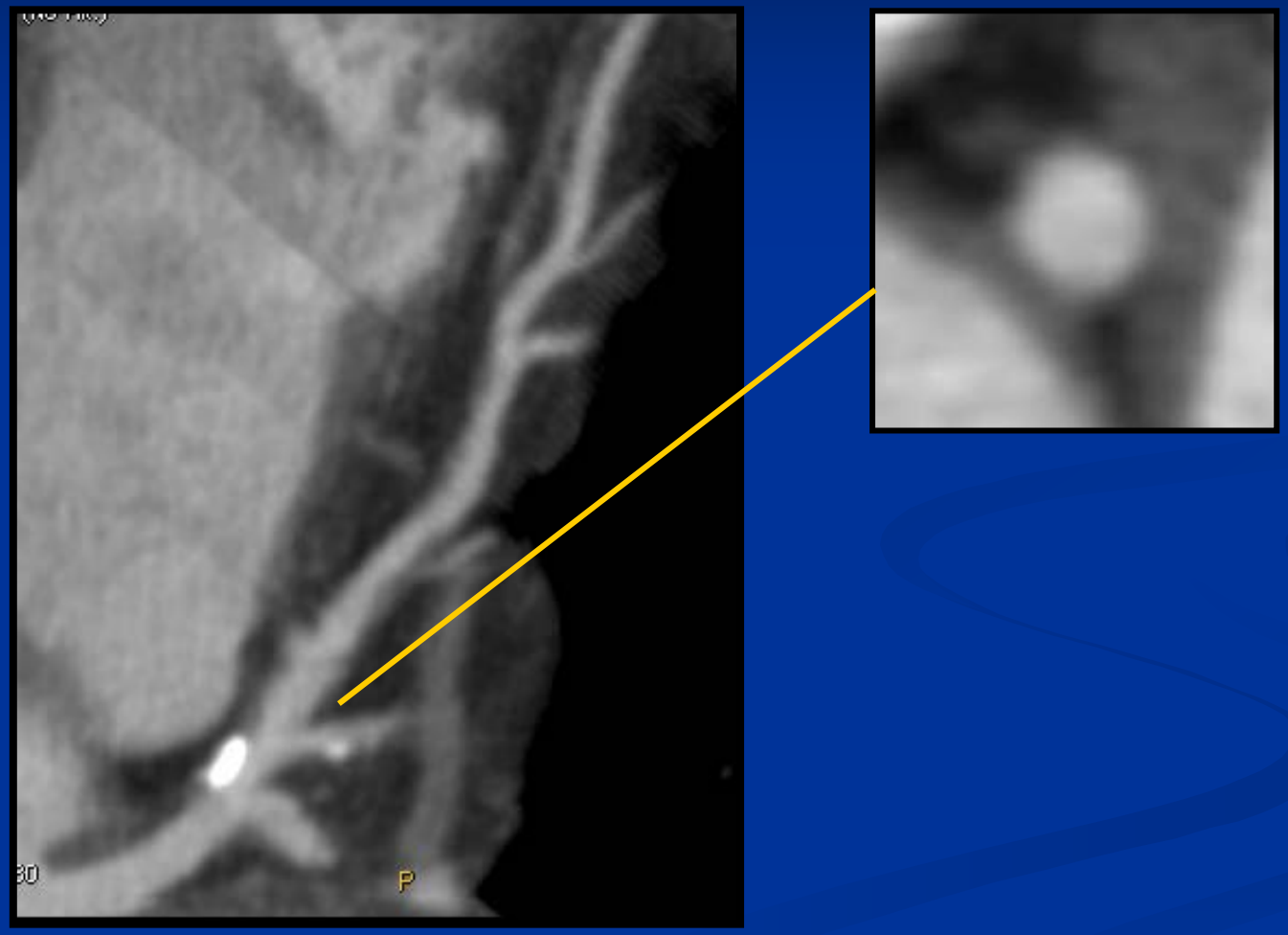
Prevalence of plaque by Risk Factors (RF)



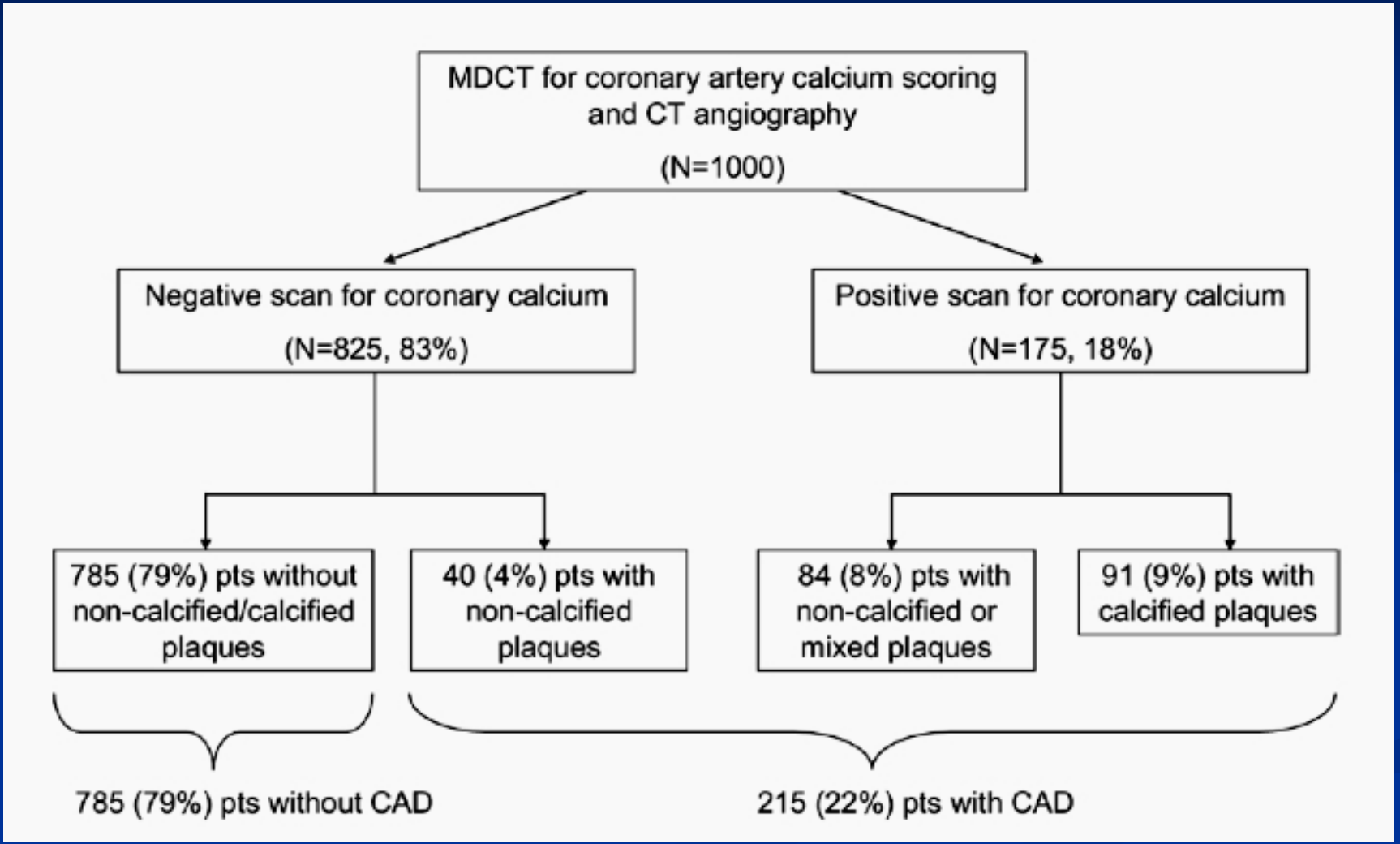
N= 163 symptomatic pts, age 65

Radiol Med. 2008;113:363-72

Routine screening-asymptomatic

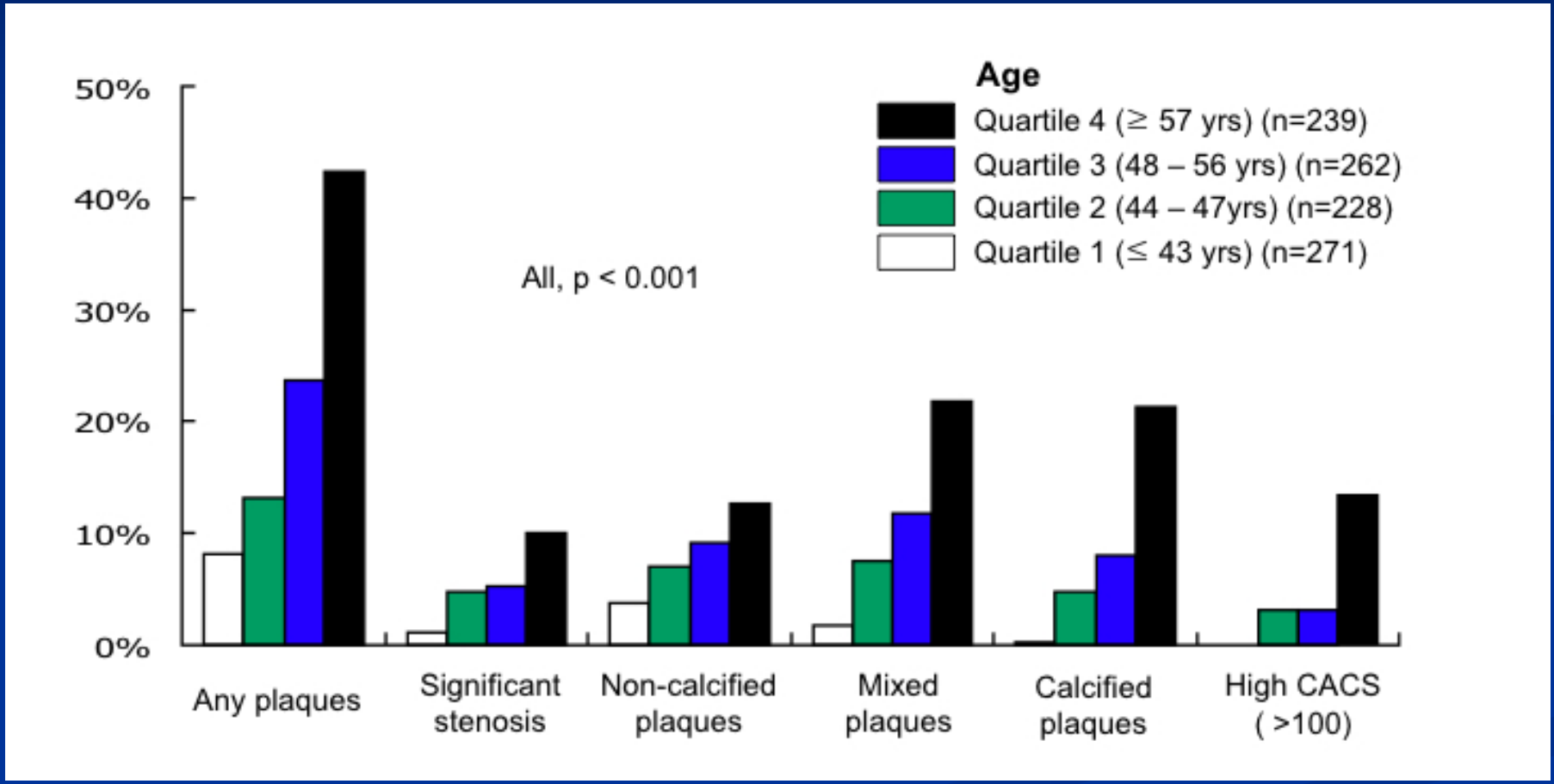


Asymptomatic screening



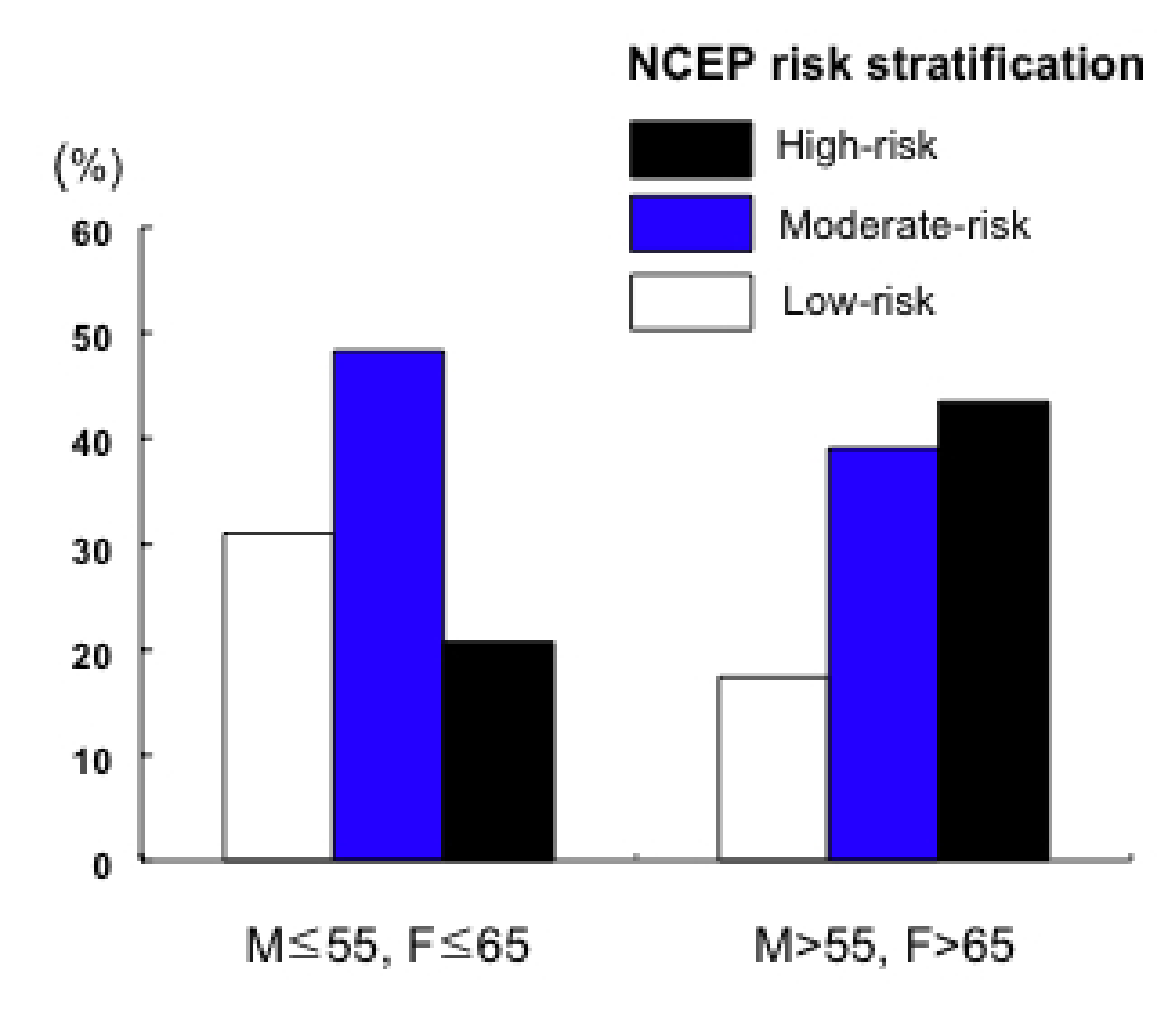
J Am Coll Cardiol 2008;52:357-65

Asymptomatic: frequent disease



J Am Coll Cardiol 2008;52:357-65

Asymptomatic: failure of classic risk factors to identify significant stenoses



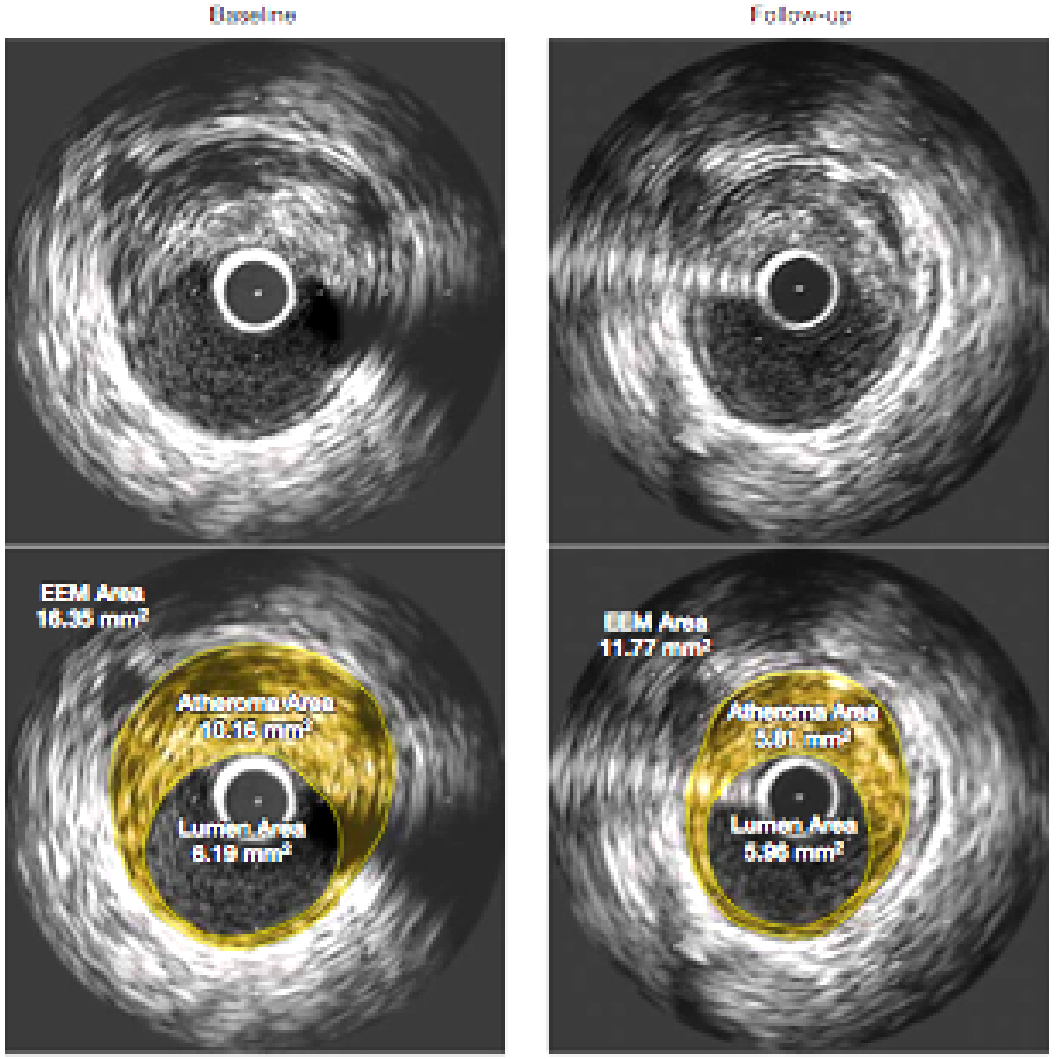
J Am Coll Cardiol 2008;52:357-65

Asteroid

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

JAMA 2006;295:epub

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 mm^2 to 5.81 mm^2. EEM indicates external elastic membrane.

Effect of Statins on Fibroatheroma

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

Laboratory data and IVUS measurements

	FluvastatinBaseline	Fluvastatinafter 12 mo	p value	Control Baseline	Control after 12 mo	p value
Low-density lipoprotein-cholesterol, mg/dl	134±37	101±34	0.0008	122±22	126±39	0.69
Average length of FA, mm	12.4±5.9	12.9±7.1	0.78	15.5±9.3	15.8±8.8	0.66
Remodeling Index	1.13±0.12	1.14±0.12	0.88	1.13±0.15	1.20±0.19	0.01
Vesse area, mm^2	15.3±3.7	14.8±4.1	0.0001	16.4±4.3	16.7±4.3	0.56
Lumen area, mm^2	6.4±1.9	7.0±2.2	0.001	7.5±2.3	6.6±2.0	0.001
Plaque area, mm^2	8.8±2.3	7.6±2.1	0.001	8.8±2.5	10.1±2.9	0.001
Fibrous area, mm^2	3.19±1.20	2.54±1.23	<0.0001	3.16±1.30	3.79±1.52	0.0001
Fibro-fatty area, mm^2	1.36±0.86	0.65±0.38	0.0001	1.27±0.77	1.16±0.83	0.26
Necrotic core area, mm^2	0.61±0.43	0.65±0.38	0.34	0.55±0.34	1.01±0.56	<0.0001
Dense calcium area, mm^2	0.25±0.23	0.35±0.27	0.01	0.33±0.28	0.59±0.42	0.0001

ESC abstract 2008

Reports of the future:

On the *AJR* Digital Viewbox

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Regression of Coronary Atherosclerotic Plaque as Shown by CT Arteriography

Kevin M. Johnson
Yale University School of Medicine
New Haven, CT 06510
David A. Dowe
Atlantic Medical Imaging
Galloway, NJ 08205
Tara M. Catanzano
James A. Brink
Yale University School of Medicine
New Haven, CT 06510

Summary

- Angiography limited to luminal pathology
- Stress testing *by definition* cannot find subclinical disease
- Anatomic plaque quantification now easily possible with CCS, CTA, IVUS, OCT, etc.
- Plaque modification with medication possible
- CT adds value for early diagnosis and monitoring (my bias!)
- Transition to preventative treatment