



IVUS Assessment of Vascular Remodeling and Clinical Impact

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한국의 중앙에서 세계의 중앙으로
Toward the University of the world from Chung-Ang of Korea





Case

Male / 72, NSTEMI

Chief complaint: resting chest pain

Past medical history: acute MI, inf. wall. 1997

Risk factors: DM(+), Hypertension(+), Dyslipidemia(+)

Lab: Peak Troponin I 1.366 ng/ml, CK-MB 8 mg/dl

Total cholesterol 116 mg/dl, LDL 76 mg/dl, HDL 32 mg/dl, TG 163 mg/dl

EKG: Q wave, II,III,aVF

T wave inversion, V1-5

Chest PA: n-c

Echo: Akinesia of basal inferior wall

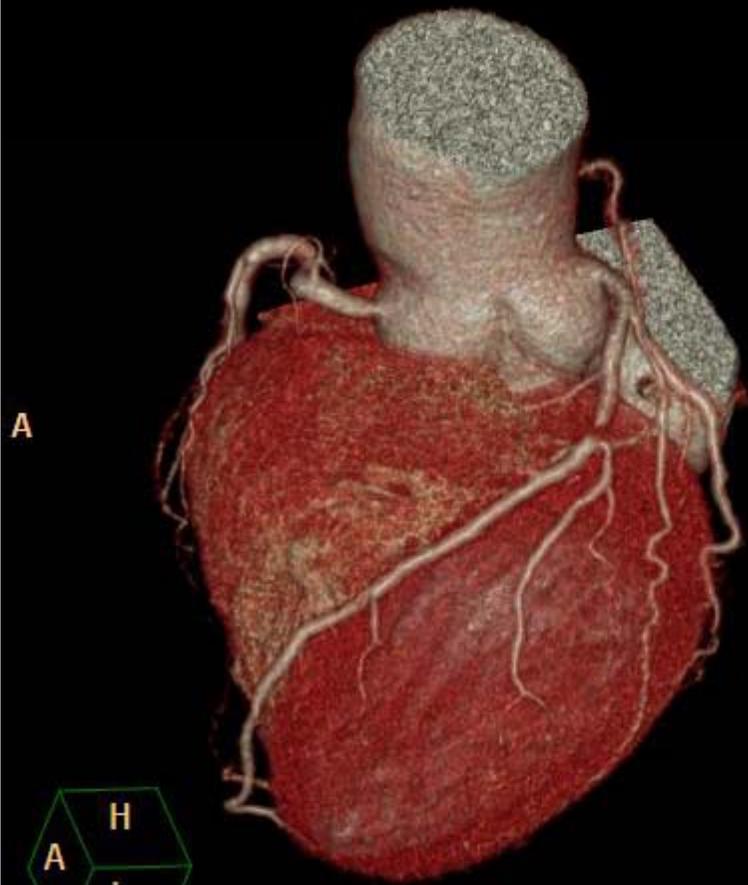
Hypokinesia of apical septal wall

Normal LV systolic function, EF= 61%

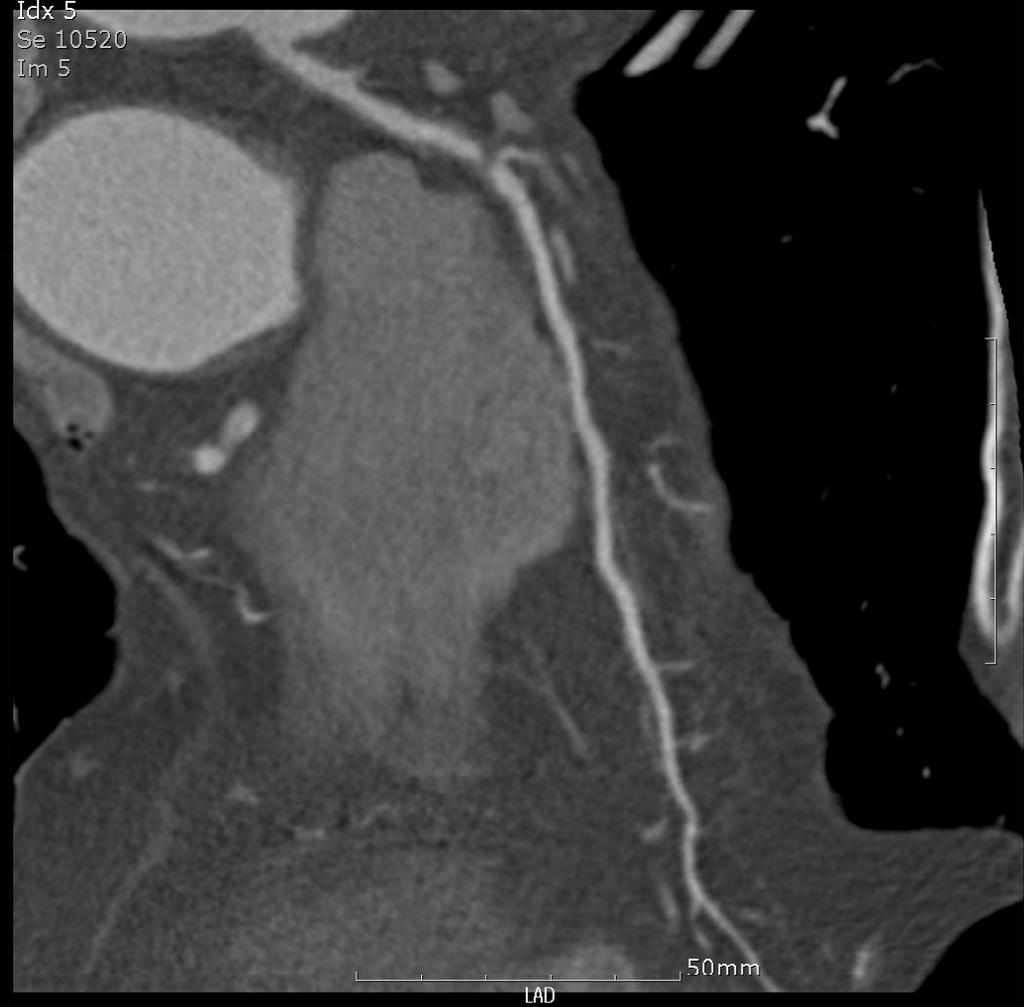


Coronary artery CT (Philips® 256 CT)

Idx 3
Se 10522
Im 3



Idx 5
Se 10520
Im 5



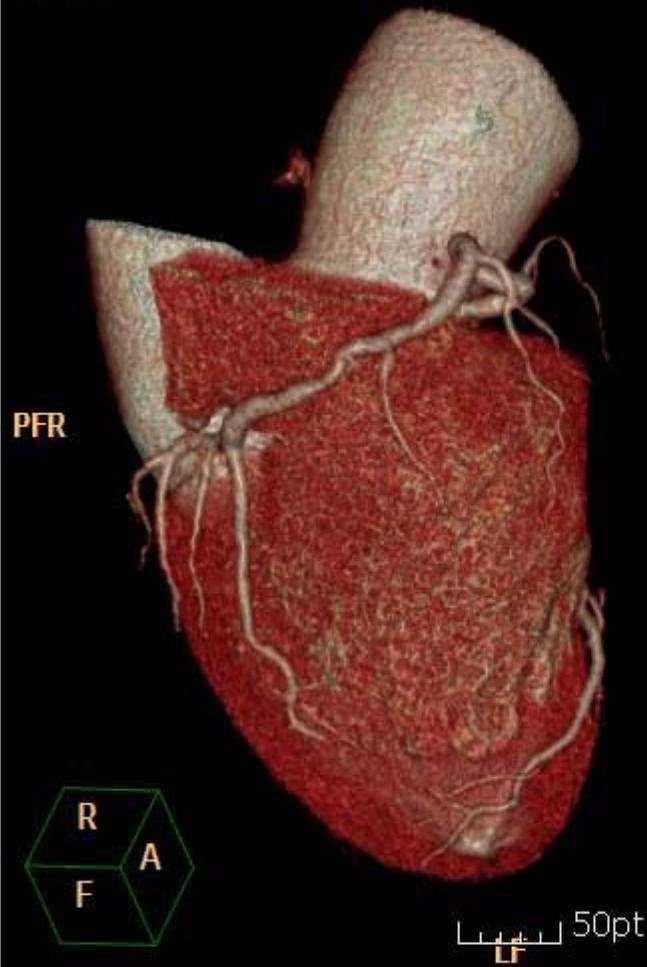


Coronary artery CT (Philips® 256 CT)

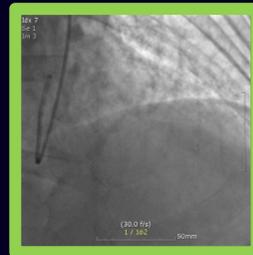
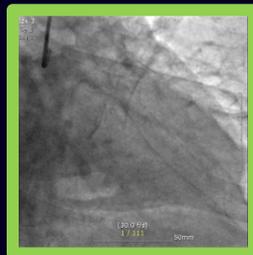
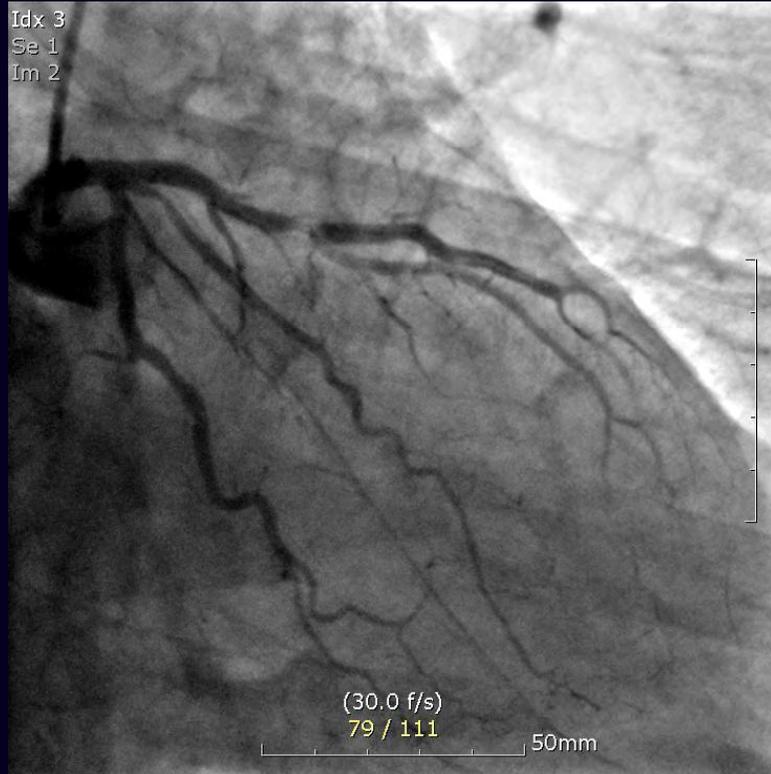
Idx 10
Se 10522
Im 10

Idx 5
Se 10519
Im 5

KCV

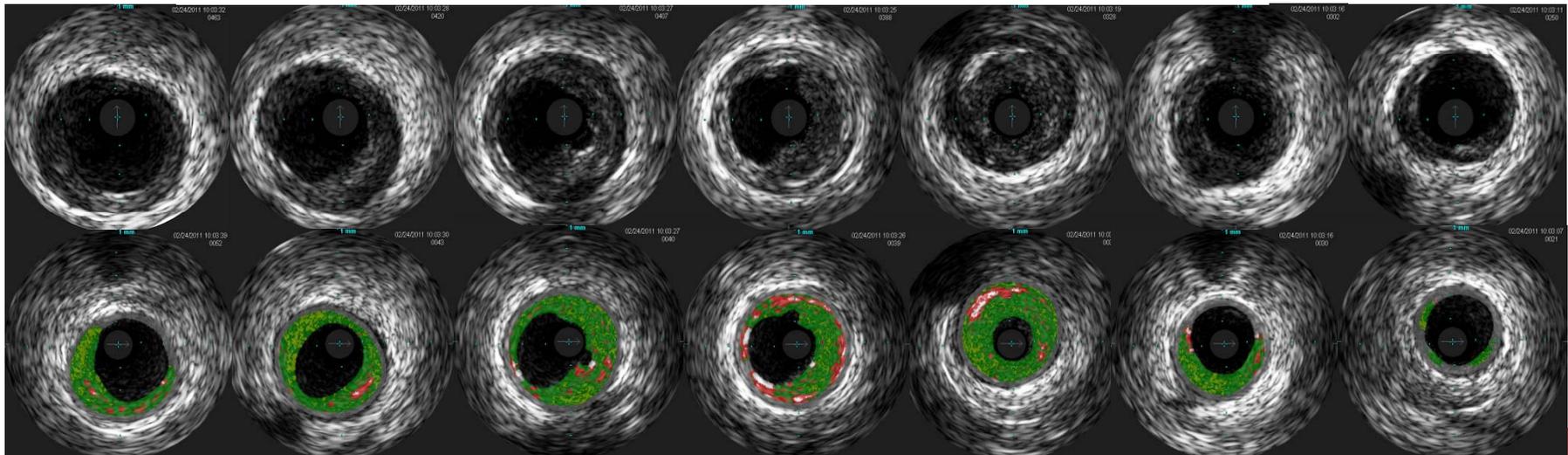
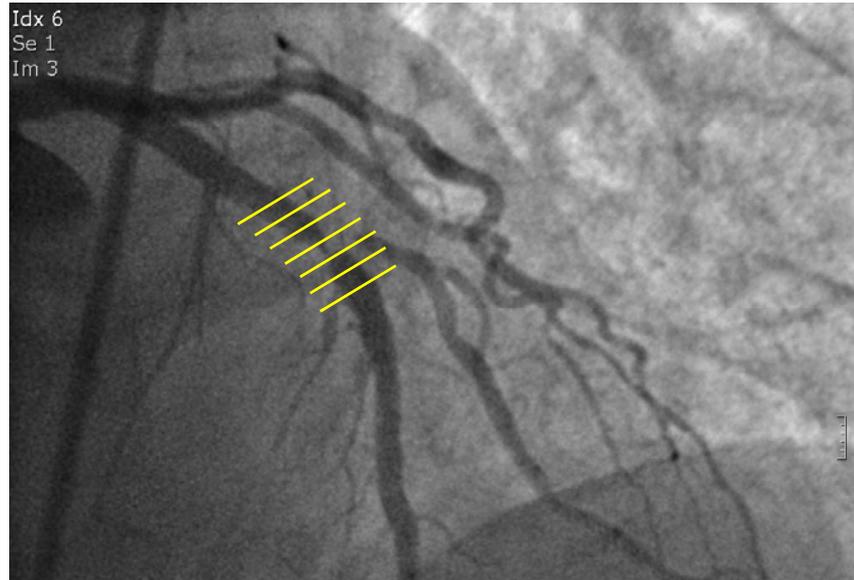


CAU





Intravascular Ultrasound

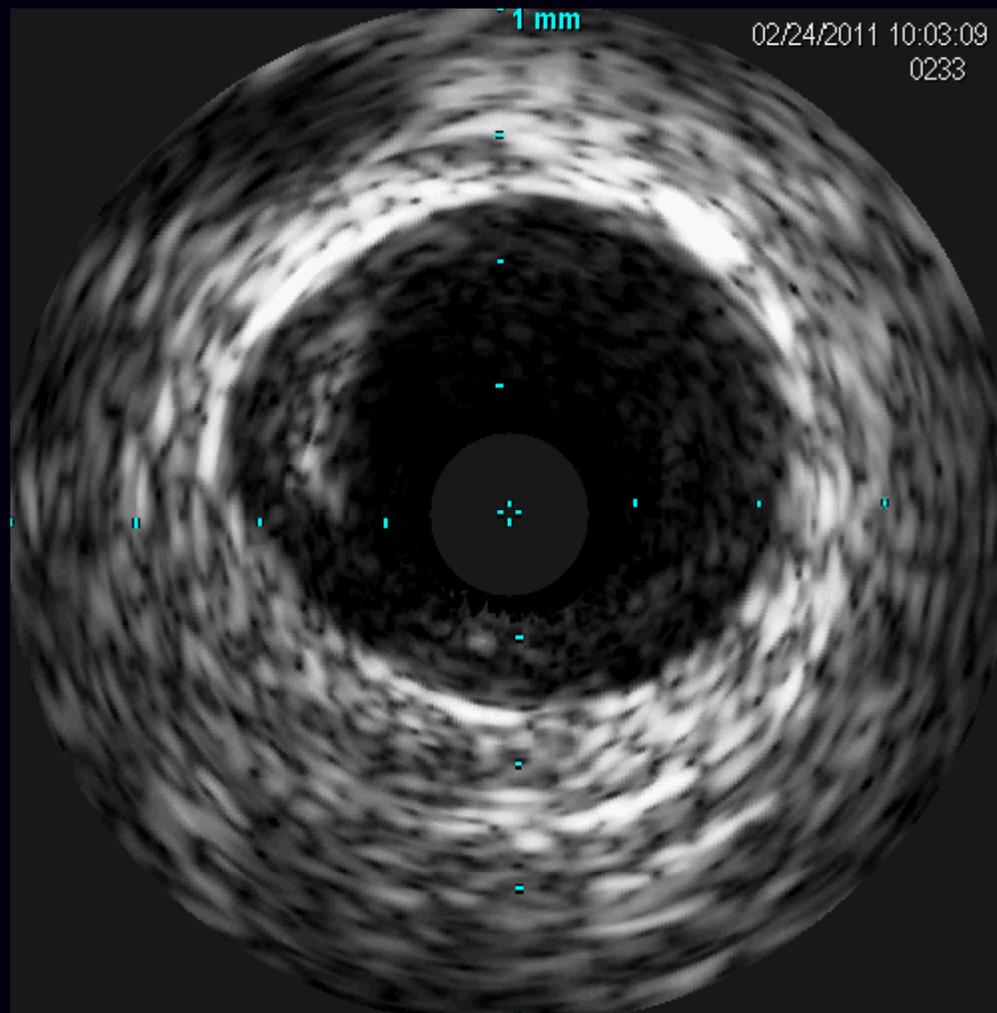


Proximal LAD ←

Remodeling index: 1.2

→ Mid LAD

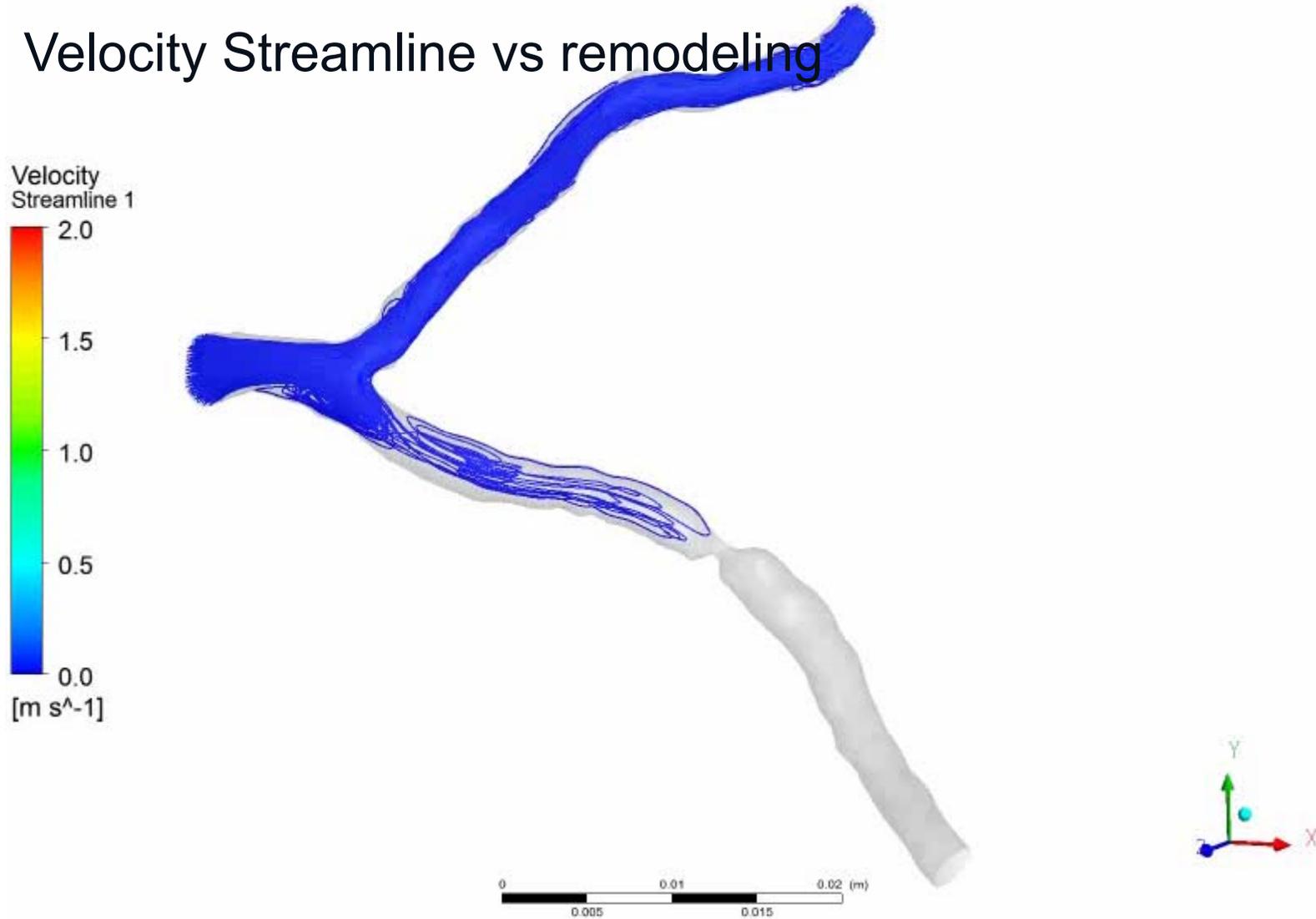




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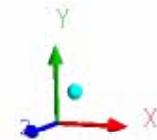
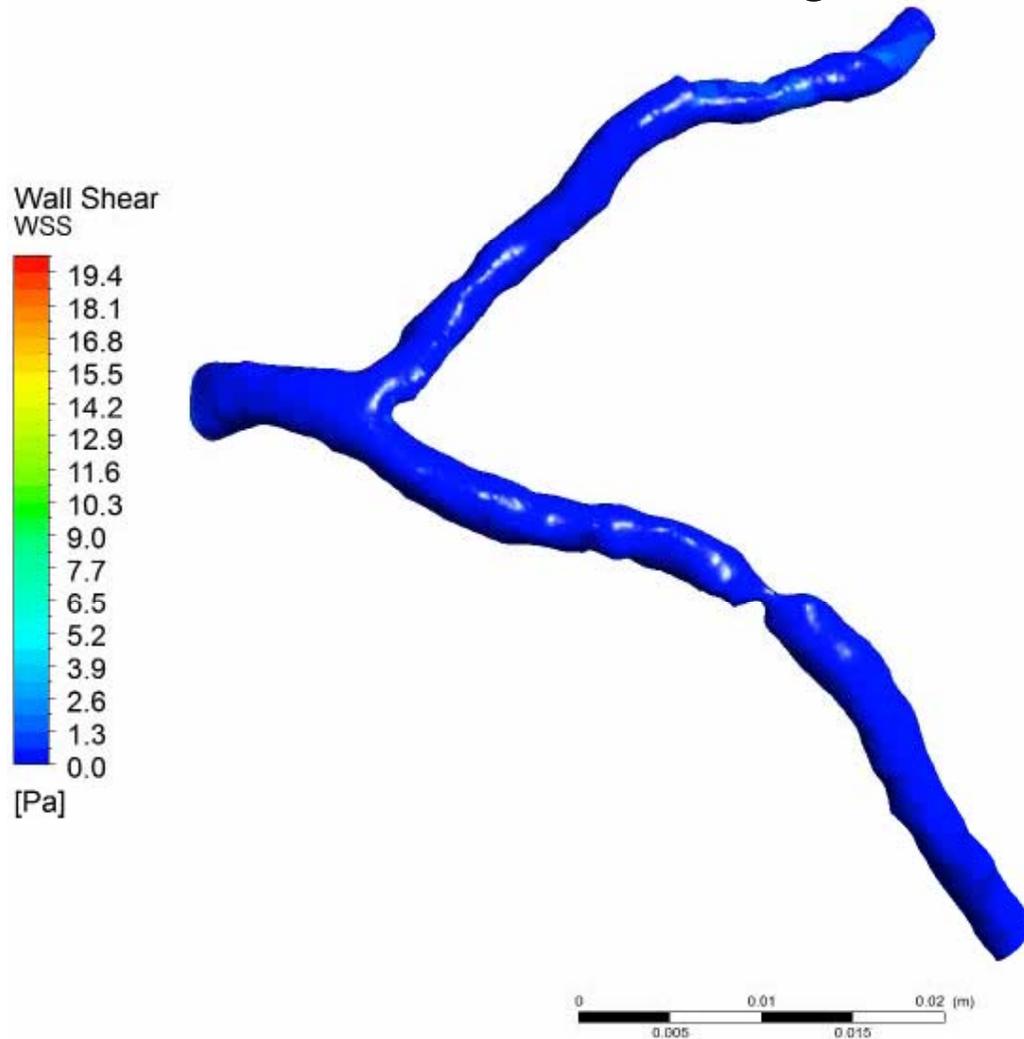
IFAD study; IVUS validated CFD

Velocity Streamline vs remodeling



IFAD study; IVUS validated CFD

Wall Shear Stress vs remodeling





Definition of Plaque Remodeling

Vascular remodeling refers to the increase or decrease in external elastic membrane (EEM) area that occurs during the development of atherosclerosis.

(Glagov et al. *N Engl J Med* 1987;316:1371–1375.)

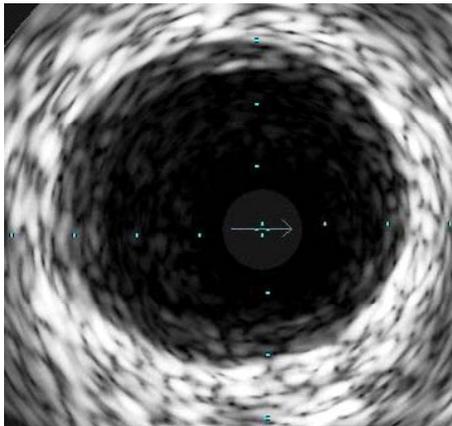
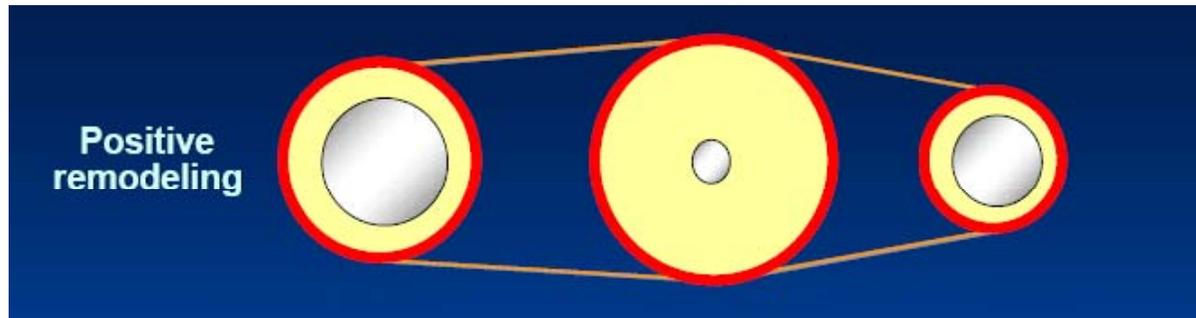
If EEM area increases during atheroma development, the process is termed “positive remodeling.” If the EEM decreases, the process is termed “negative” or “constrictive remodeling.” (Mintz et al. *J Am Coll Cardiol* 2001;37:1478-1492)

Remodeling is assessed by means of the remodeling index (RI), expressed as the lesion site EEM area divided by the reference EEM area. Positive remodeling is defined as $RI \geq 1.05$ and negative remodeling as $RI \leq 0.95$.

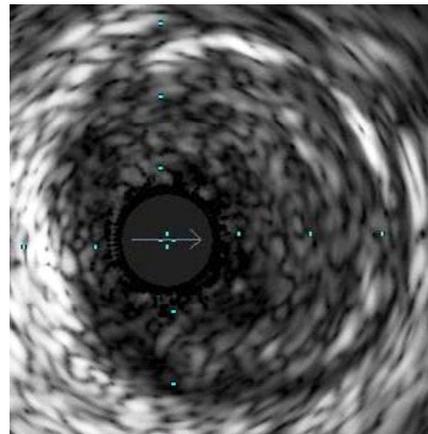
(Nakamura et al, *J Am Coll Cardiol* 2001;37:63–69) (Schoenhagen et al. *Circulation* 2000;101:598–603)

(Gussenhoven et al. *Am J Cardiol* 1997;79:699–702)

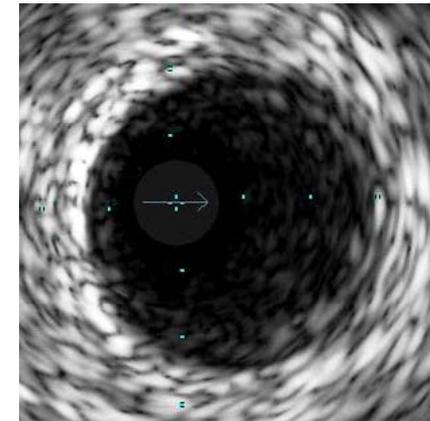
Positive remodeling



Proximal reference

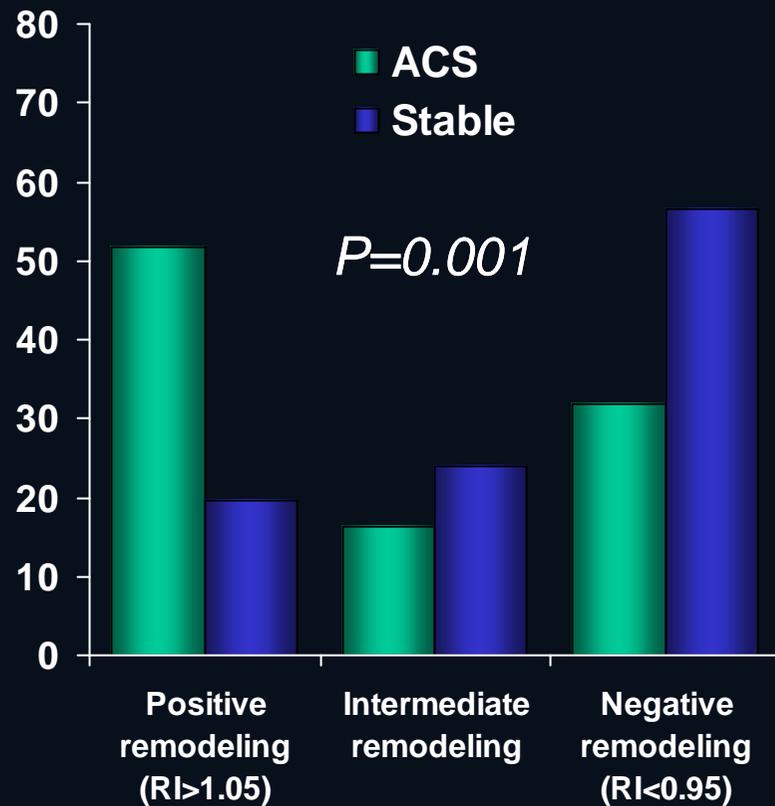


Lesion site

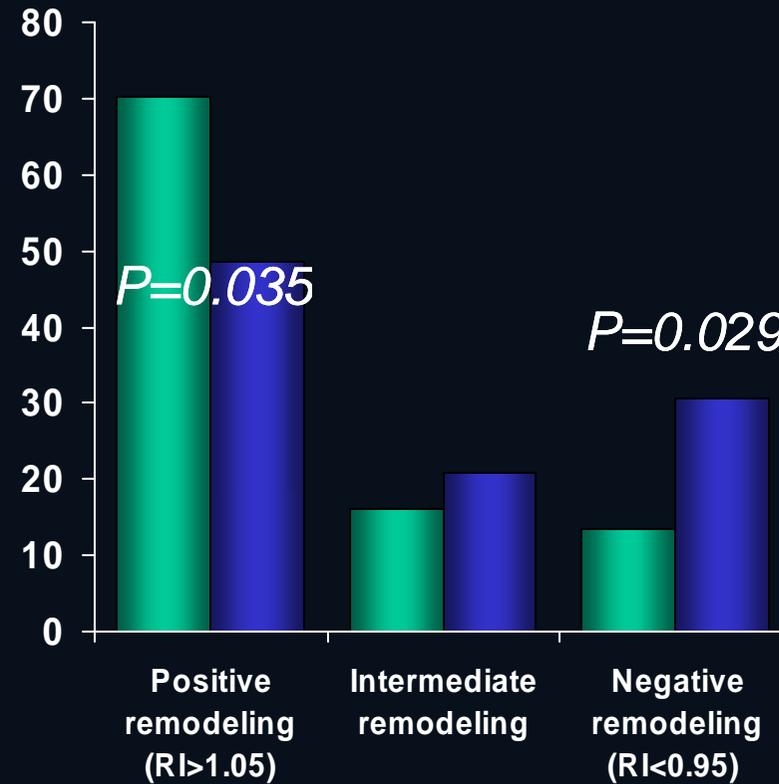


Distal reference

Association of positive remodeling and ACS

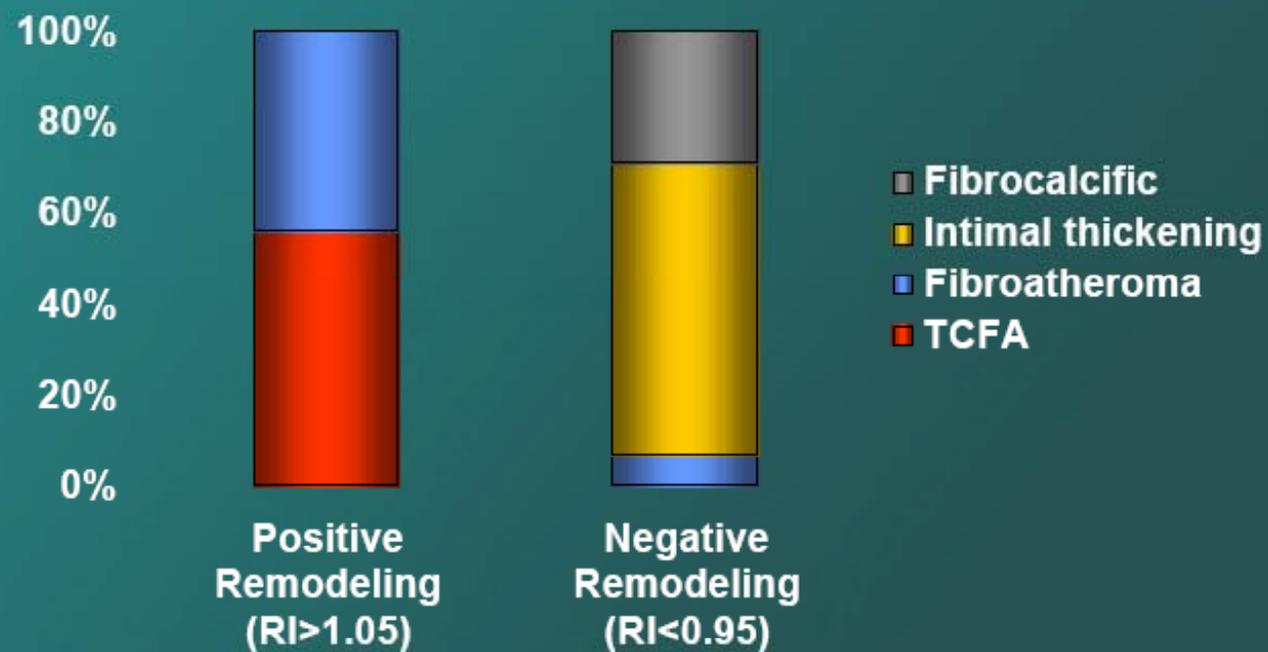


Schoenhagen et al. Circulation 2000;101:598-603



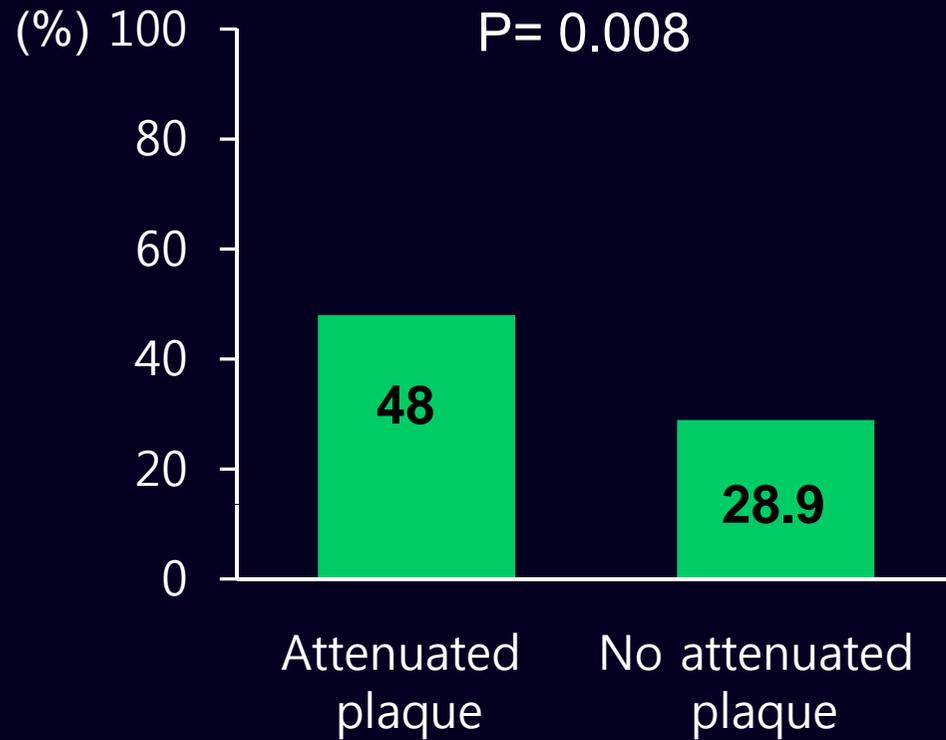
Prati et al. Circulation 2003;107:2320-5

Lesion Types and Remodeling

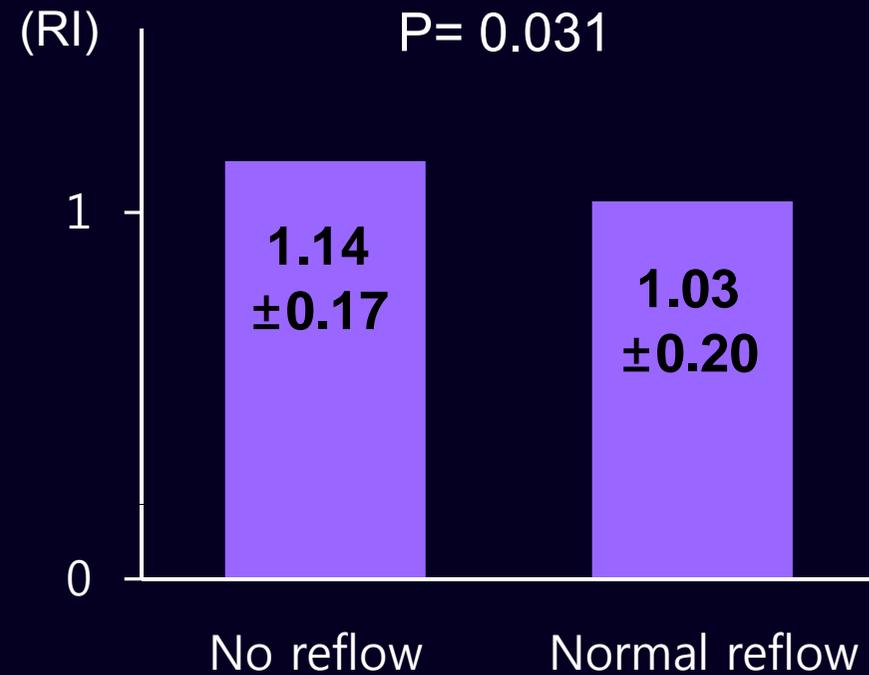


(Rodriguez-Granillo, et al. Heart 2006;92:388-391)

Positive Remodeling

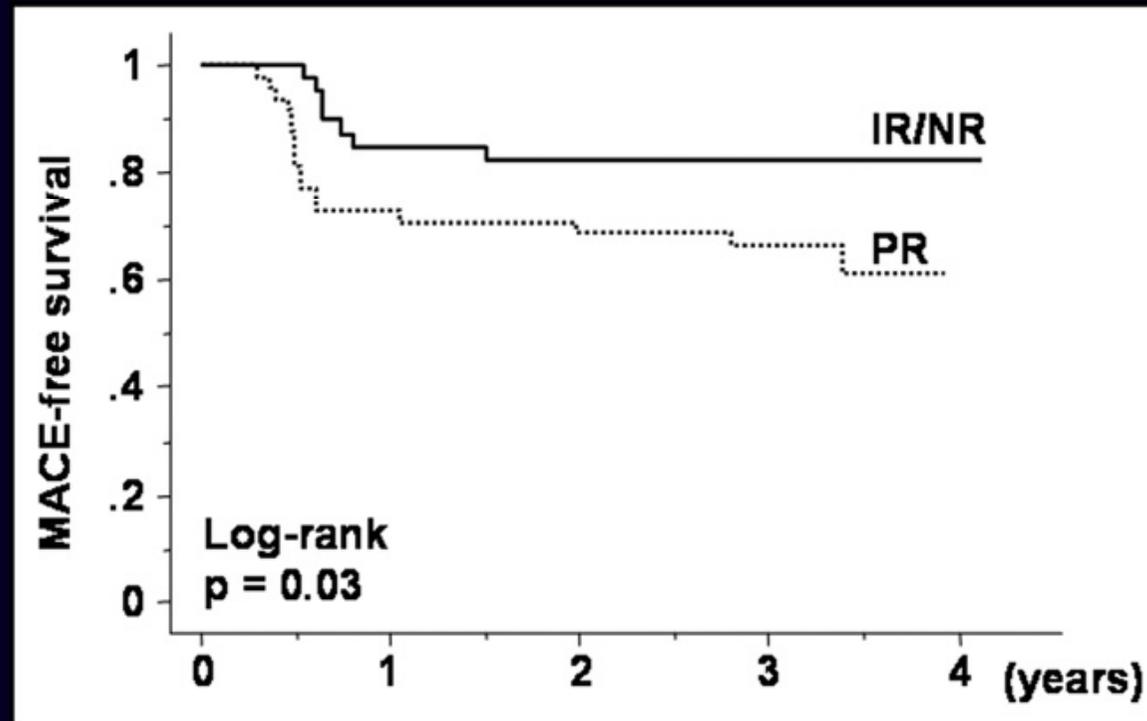


Lee et al. *J Am Coll Cardiol Interv* 2009;2:65–72



Hong et al. *J Cardiol* 2009;54:36–44

Culprit lesion remodeling rather than the presence or absence of culprit-lesion plaque rupture was **a strong predictor of long-term clinical outcome (3-year)** in acute coronary syndrome



Okura et al. *Am J Cardiol* 2009;103:791–795



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