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Coronary CTA for the Risk of MI

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Disclosure

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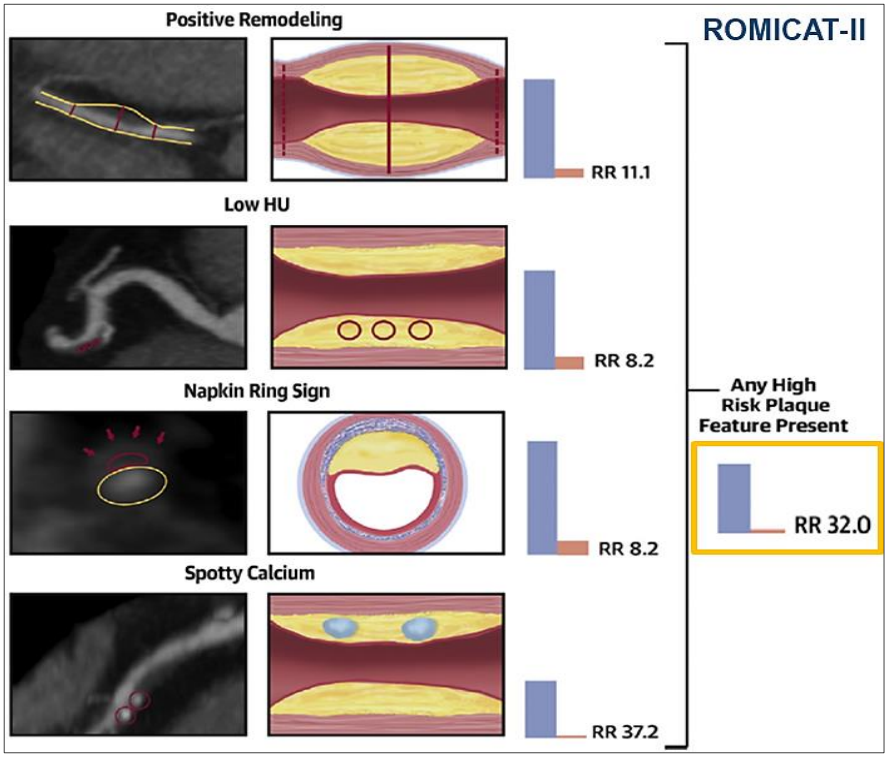
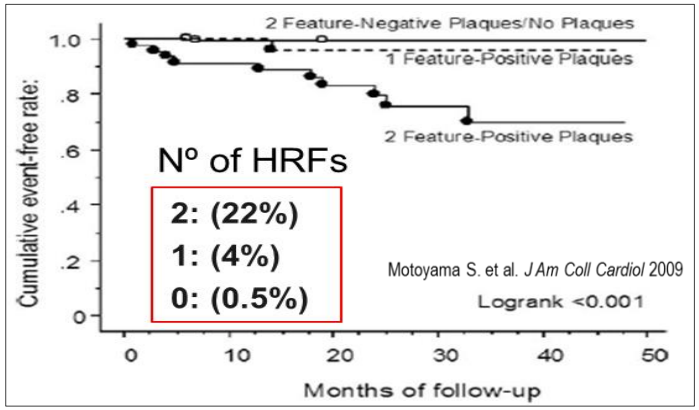
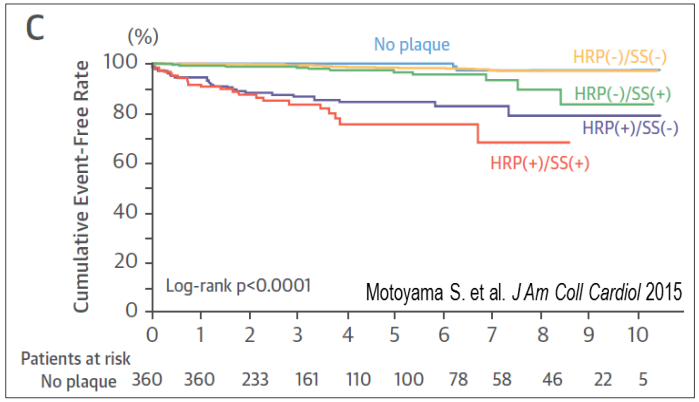
High-Risk Plaque Features by cCTA

High-risk plaque (Vulnerable plaque) assessed by CCTA

- More commonly found in ACS culprit lesions
- Associated with clinical outcomes







Source: Motoyama S. et al. *J Am Coll Cardiol* 2009; Puchner et al., *J Am Coll Cardiol* 2014; Motoyama S. et al. *J Am Coll Cardiol* 2015

Limitation of literatures

- Although previous studies found that so-called "***High-risk plaques***" features assessed by non-invasive imaging are associated with clinical outcomes,

But, these studies has been limited by

1. Small study samples
2. Qualitative evaluation
3. Evaluation at the time of or after ACS (retrospectiveness)
4. Secondary prevention populations
5. Few outcomes (non-invasive [n=15]; invasive [n=31])

Source: Motoyama S. et al. *J Am Coll Cardiol* 2009; Puchner et al., *J Am Coll Cardiol* 2014; Motoyama S. et al. *J Am Coll Cardiol* 2015

Prediction of Event: Limitations of literatures

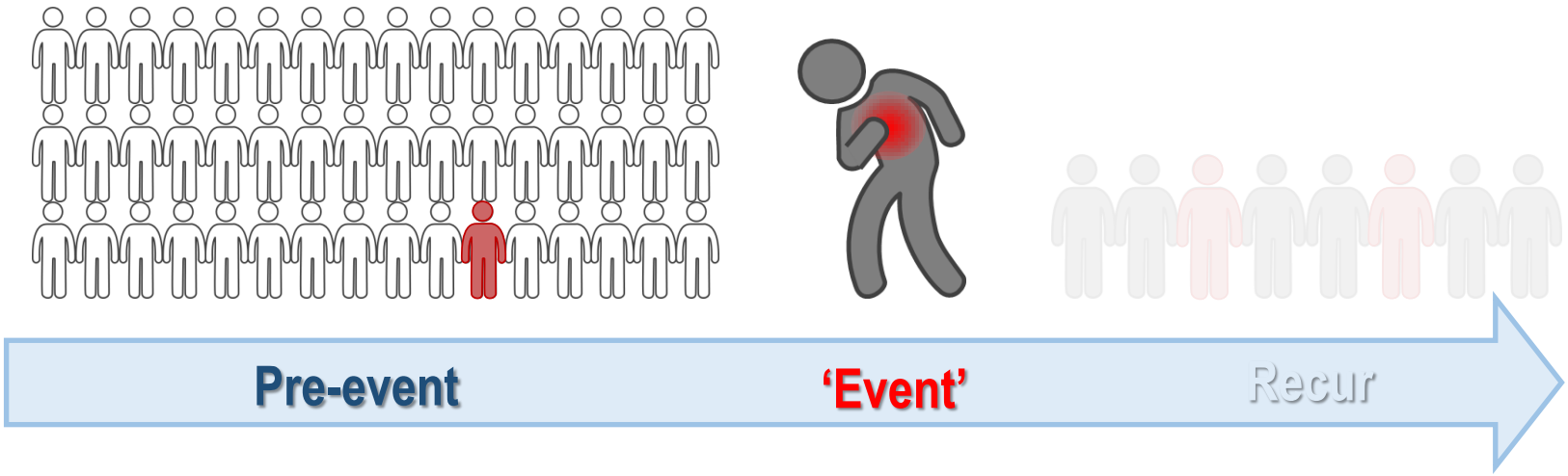
- **Previously, all studies about coronary CTA were from the 'post-event' setting based on the assumption,**
  the characteristics of 'pre-event' vulnerable plaque would be similar to one of disrupted plaque.

- **Evident active inflammation in MI patients** not only within the culprit lesion and vulnerable plaques but also involved stable plaques

- **Post-MI treatments** (revascularization, intensive medical treatment) may affect the natural course of plaque progression.

Asakura M. et al. JACC. 2001; Mauriello A. et al. JACC. 2005; Tanaka A. et al. JACC. 2005

Prediction of Event: to overcome the limitations

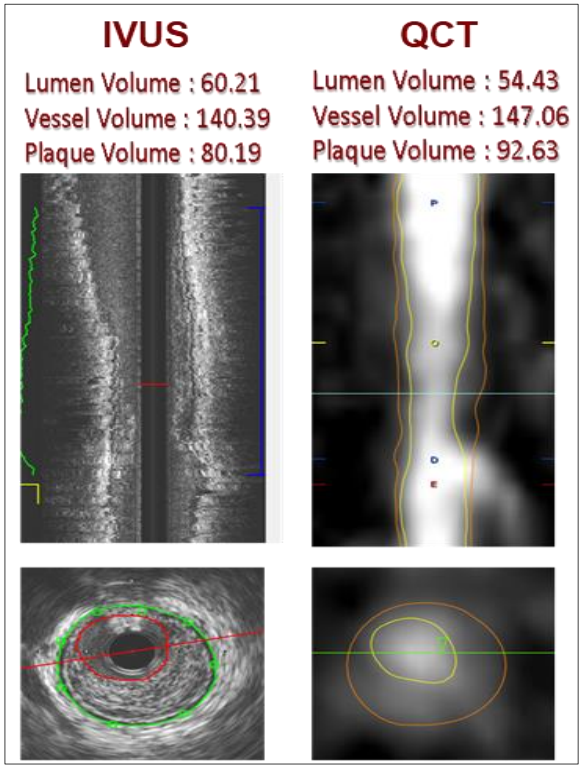


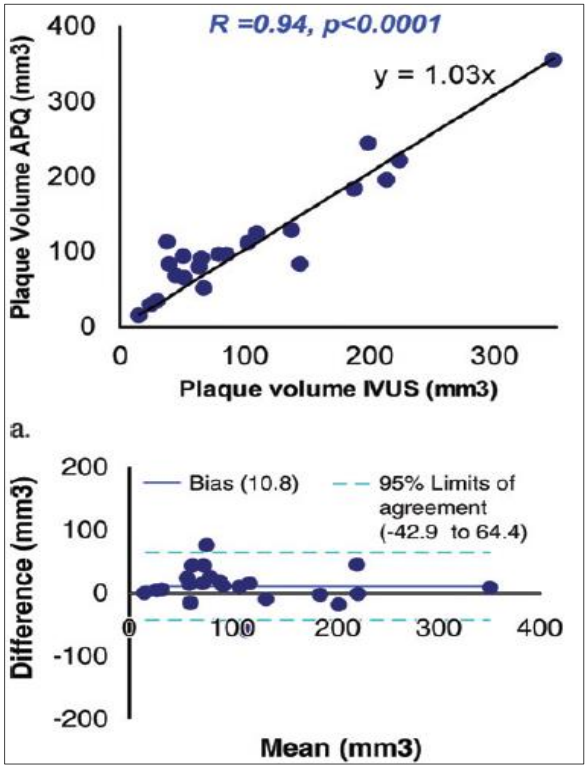
- To explore the characteristics of plaque vulnerability in 'pre-event' setting
  - '**Pre-event' CT cohort**
- To overcome the low event rate of MI from general population
  - **Large and multi-spectrum cohort of 'Primary' prevention setting**
- To assess the predictive value of imaging surrogates themselves
  - '**Well-matched' control** for clinical risk and conventional measures of CAD severity

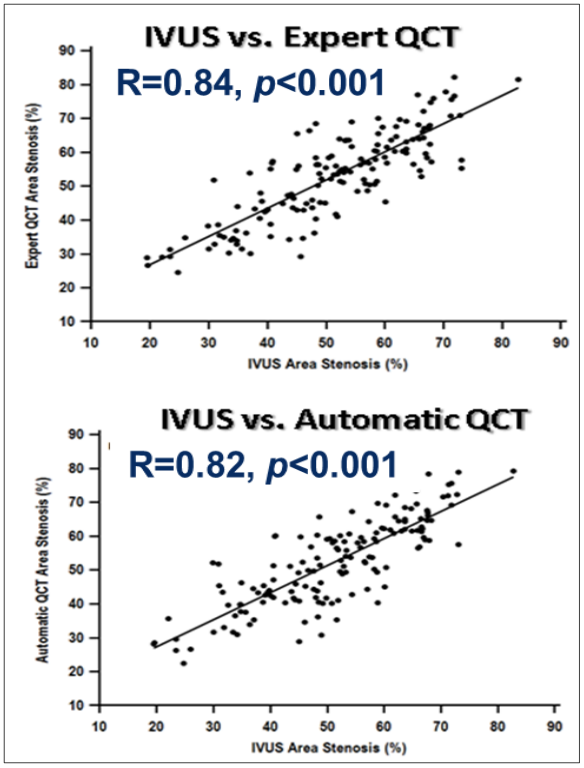
Motoyama S, et al. JACC. 2009; Otsuka K, et al. JACC Imaging. 2013; Puchner SB, et al. JACC. 2014

Quantitative Plaque Analysis by cCTA

- Volumetric assessment of cCTA using automated 3D software
- Validation against IVUS revealed excellent correlation
  - MLA, MLD, %AS, %DS // Plaque volume, lumen volume, vessel volume



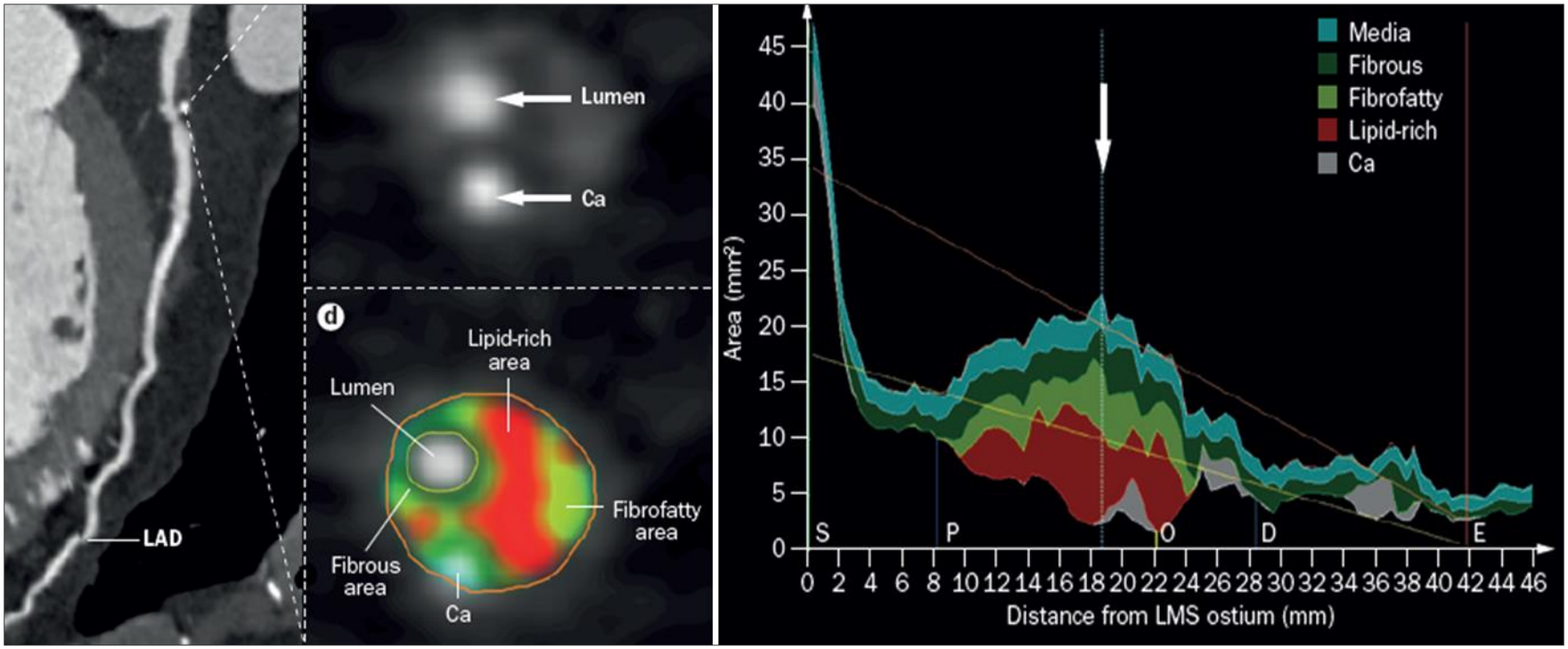




Source: Nakazato R. et al. *Eur Radiol* 2013; Dey D et al. *Radiology* 2010; Park HB and Chang HJ et al. *Eur radiol.* 2015

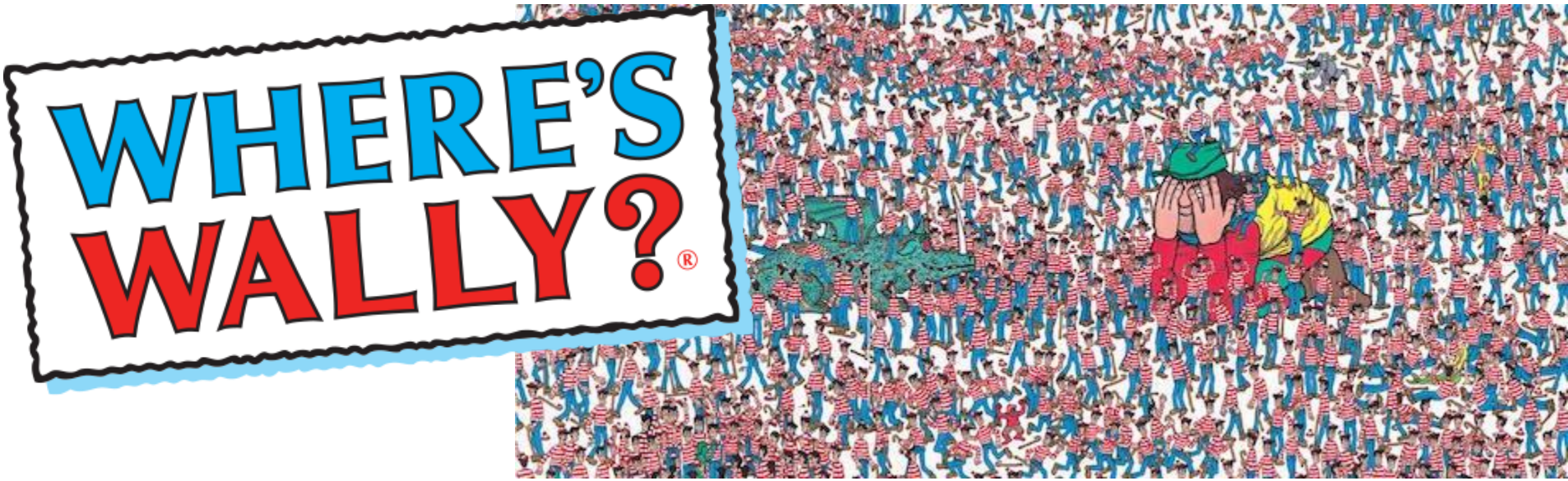
Volumetric Assessment of Plaque Composition

- Using pre-defined HU thresholds
  1) Calcified (HU>350)
  2) Non-calcified (HU≤350): Necrotic core (<30) / Fibrofatty (30-130)/ Fibrous (131-350)
- Validation against IVUS yielded excellent correlations



Source: Pundziute et al., *Eur Heart J* 2008; Maurovich-Horvat et al. *Nat. Rev. Cardiol.* 2014; Boogerset al., *Eur Heart J* 2012

Prediction of Event: CONFIRM



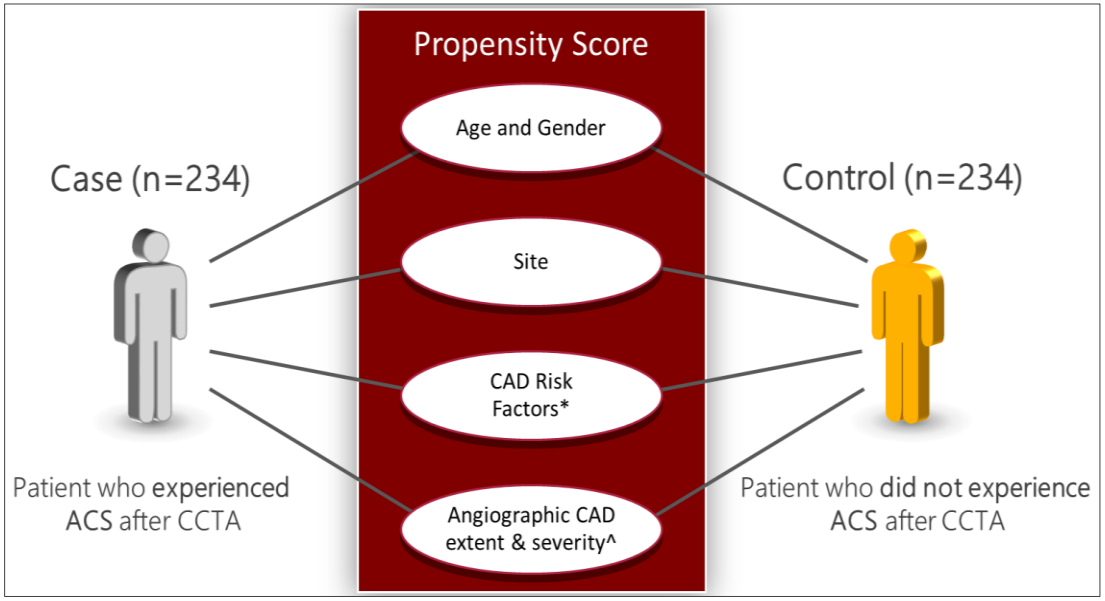
- **CONFIRM** registry

  25,251 Consecutive Pts, undergoing CCTA from 13 sites in America, Europe, and Asia

SOURCE: Min JK, et al., *JCCT*, 2011

Prediction of Event: ICONIC

- Nested CASE: Control Study of CONFIRM registry
- To precisely pinpoint APCs specifically associated with future ACS
  1) 234 patients who experienced ACS after CCTA were identified
  2) Matched 1 to 1 to 234 control patients who did not experience ACS after CCTA

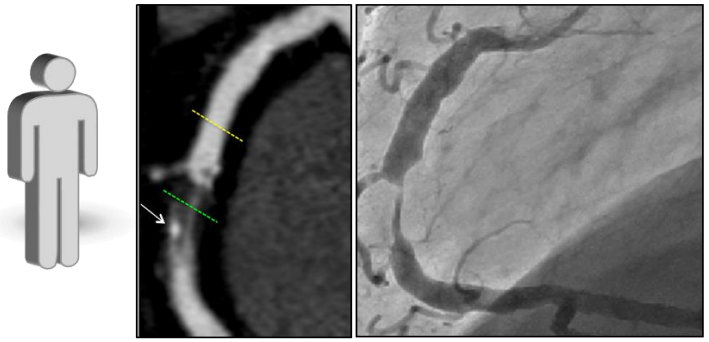


SOURCE: Chang HJ et al. *JACC* 2018

ICONIC: Culprit Lesion Comparison

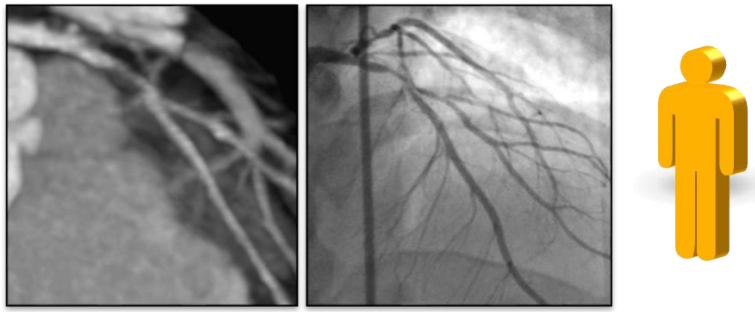
- Culprit lesions were identified in 129 patients, who underwent ICA after ACS and matched to control lesions in the non-ACS control patients

Culprit Lesion (n=129) in ACS patients



- Culprits were defined as lesion with most high-risk features, including:
  - Site of revascularization
  - Thrombus
  - Ulceration
  - Greatest % stenosis

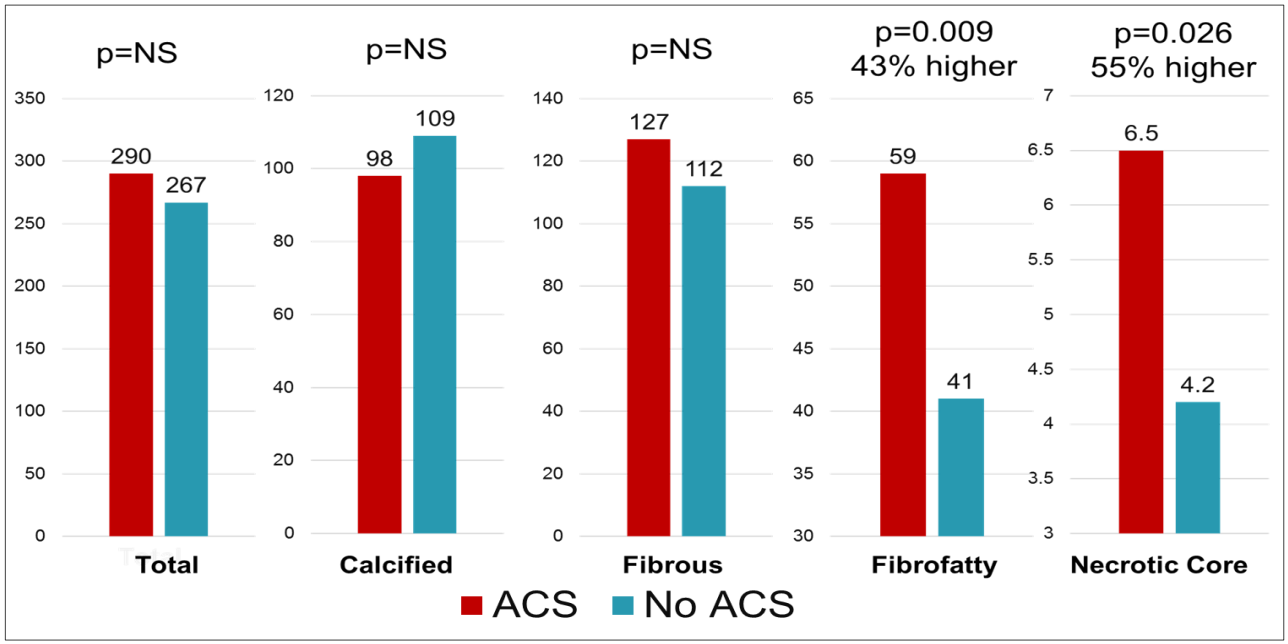
Control Lesion (n=129) in non-ACS patients



- Greatest % diameter stenosis

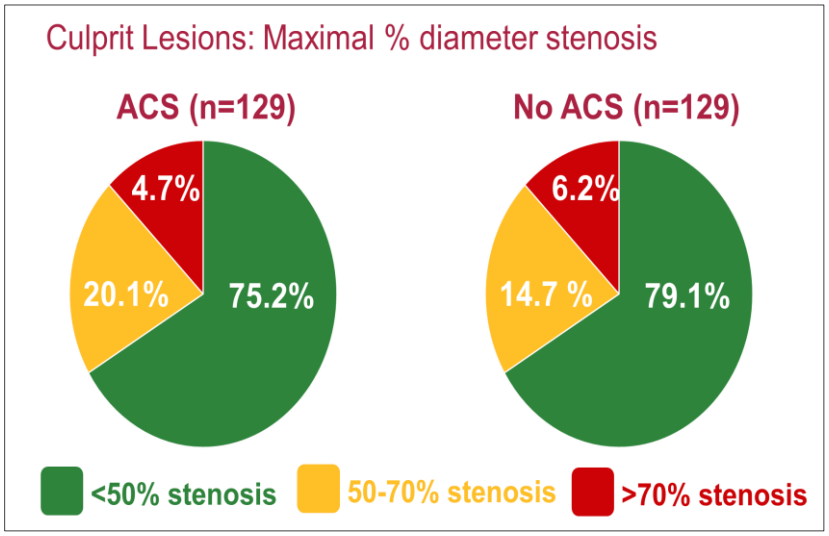
ICONIC: Per-Patient

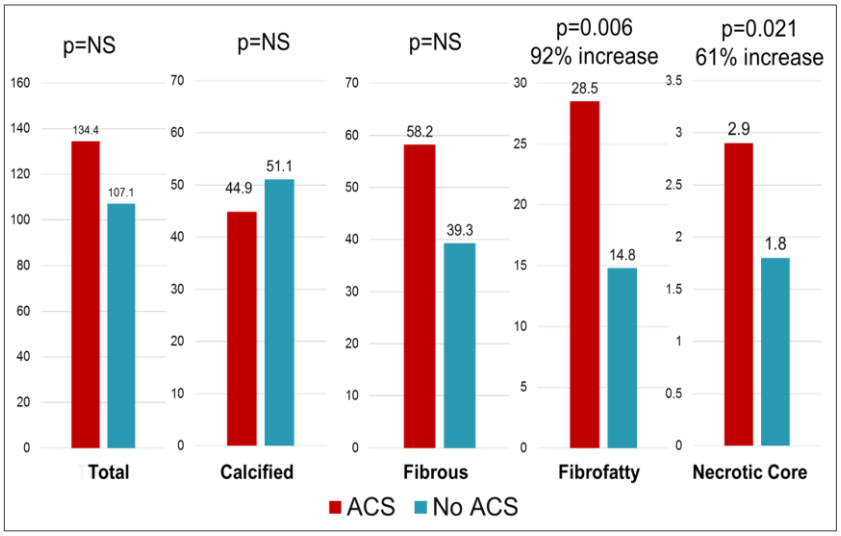
- In ACS patients, only 12.8% of them had ≥70% stenosis and **almost 70% had non-obstructive CAD** at the time of CCTA.
- ACS patients possessed higher % of HRP and fibrofatty/necrotic-core plaque volumes than non-ACS patients.



ICONIC: Per-Lesion

- **≥75% of culprit lesions were non-obstructive.**
- The rate of %DS were generally similar between ACS and no-ACS controls.
- Culprit lesion had 92% higher volume of fibrofatty and 61% higher volume of necrotic core volume, compared to their non-ACS controls.





* This Research is a Product of Yonsei Integrative Cardiovascular Imaging Research Center.

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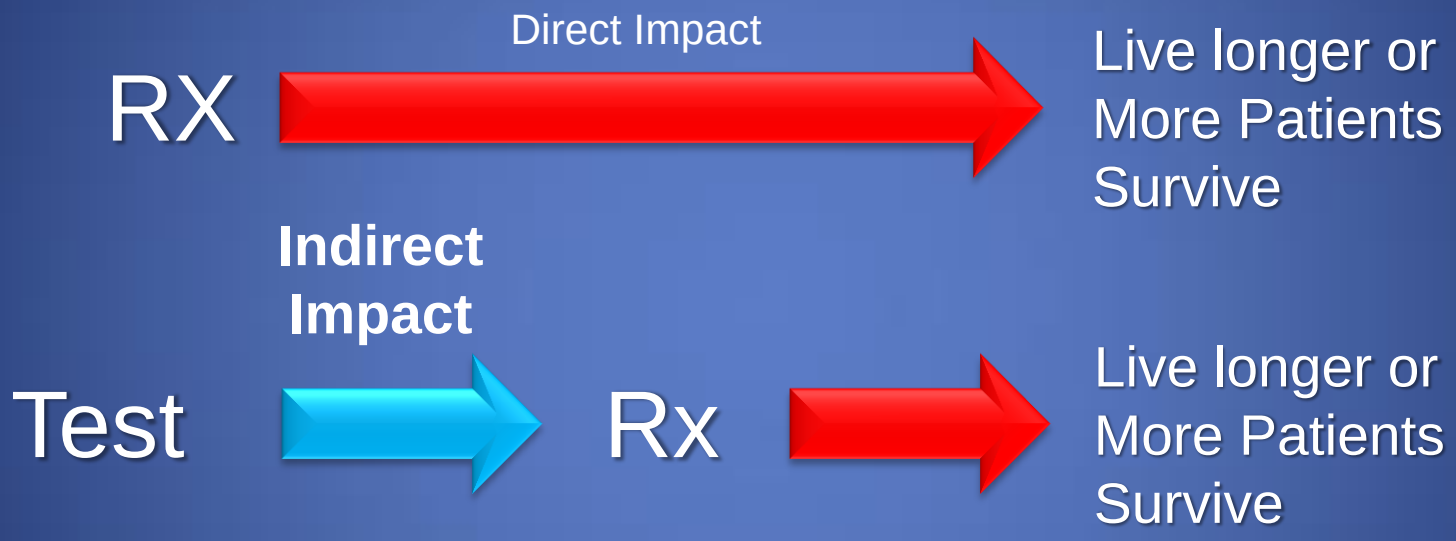
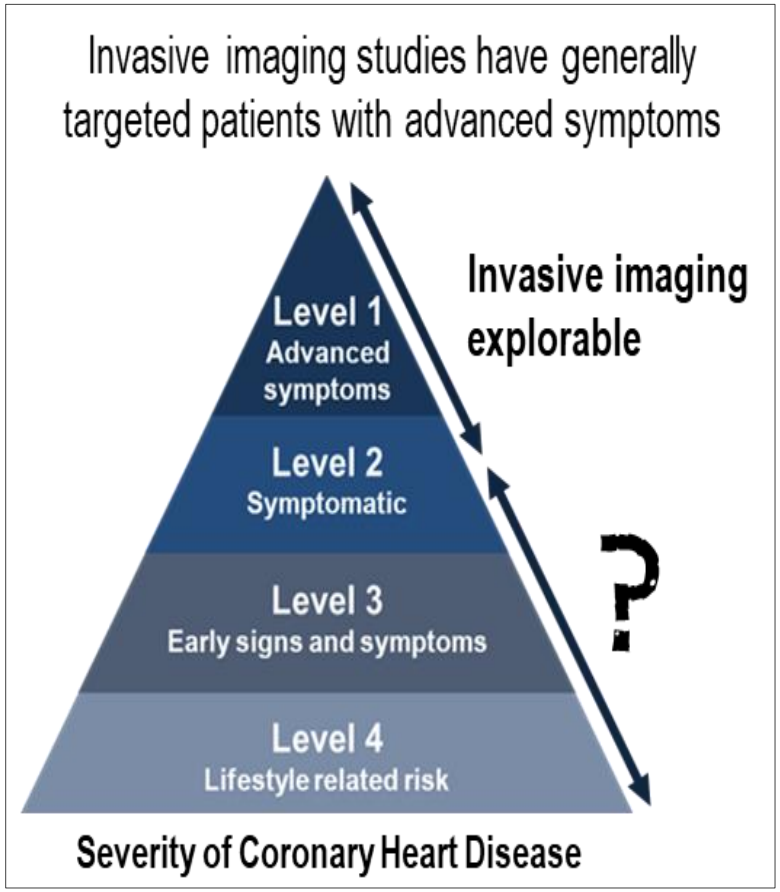
How Do We Save Lives in Healthcare?

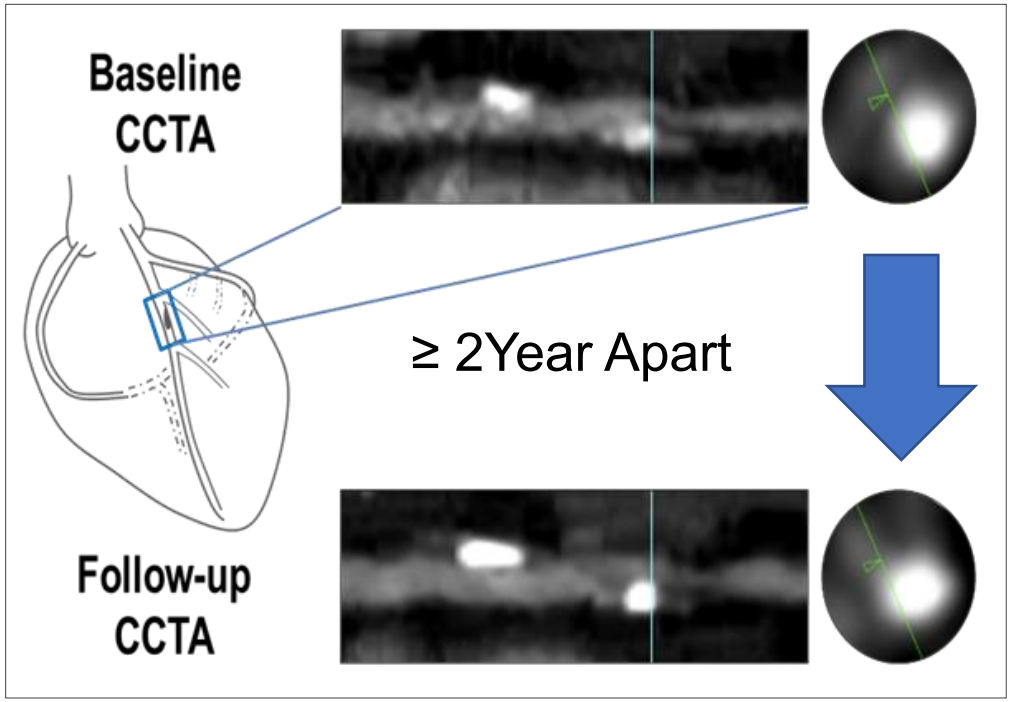


The ability of a Diagnostic Procedure to Save Lives is inextricably linked to the Appropriate initiation of Effective Therapeutic Management

Follow-up the Patient: PARADIGM



- Multicenter Registry of Consecutive Patients Who Underwent Clinically-Indicated Serial cCTA

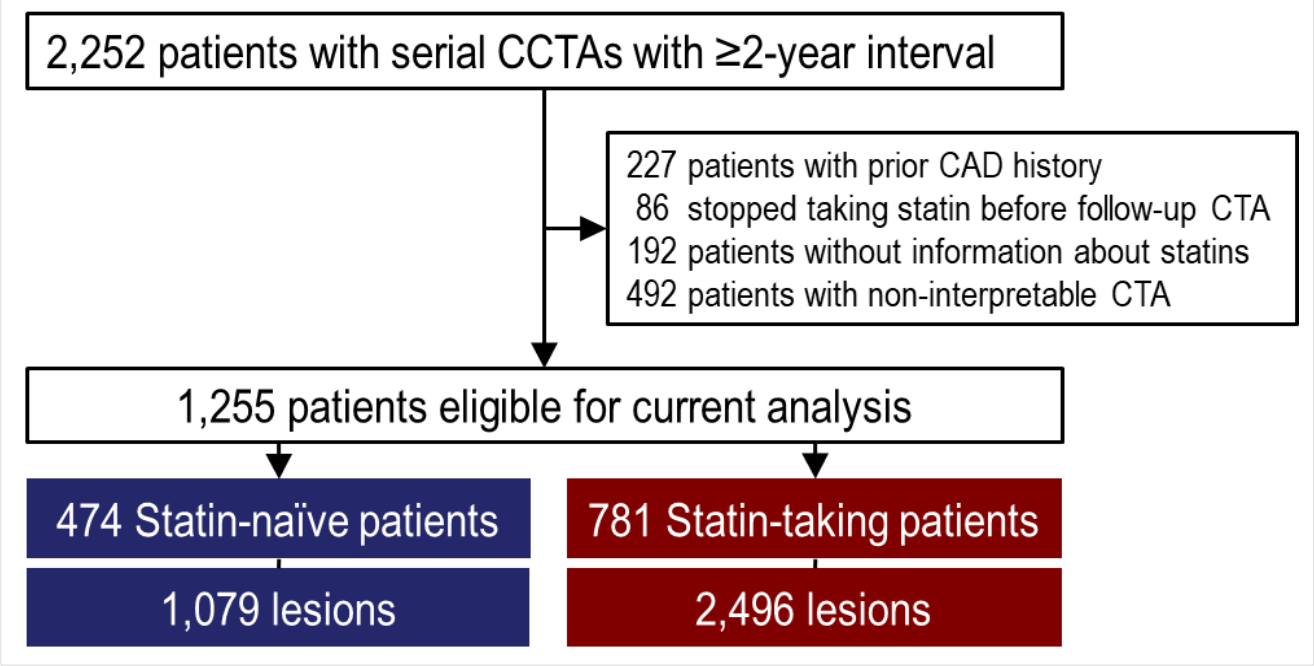


SOURCE: LEE SE, et al. AHJ 2016

Effect of Statin on Coronary Atherosclerosis: PARADIGM

- At 13 sites from 7 countries enrolled between 2003 and 2015 with 7.9±2.0 years of follow-up

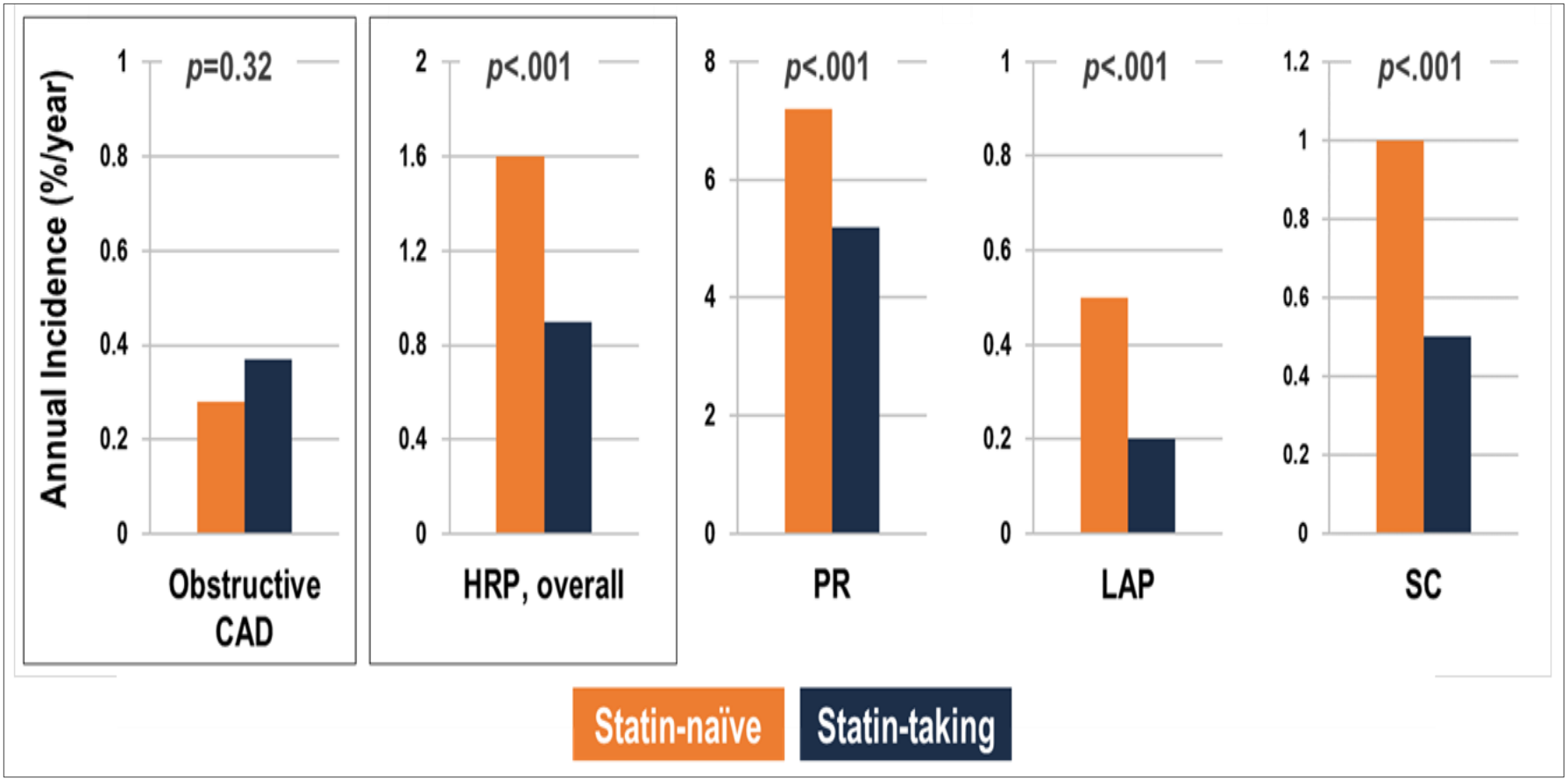
CONSORT diagram



SOURCE: Lee SE, et al. *JACCi*, 2018

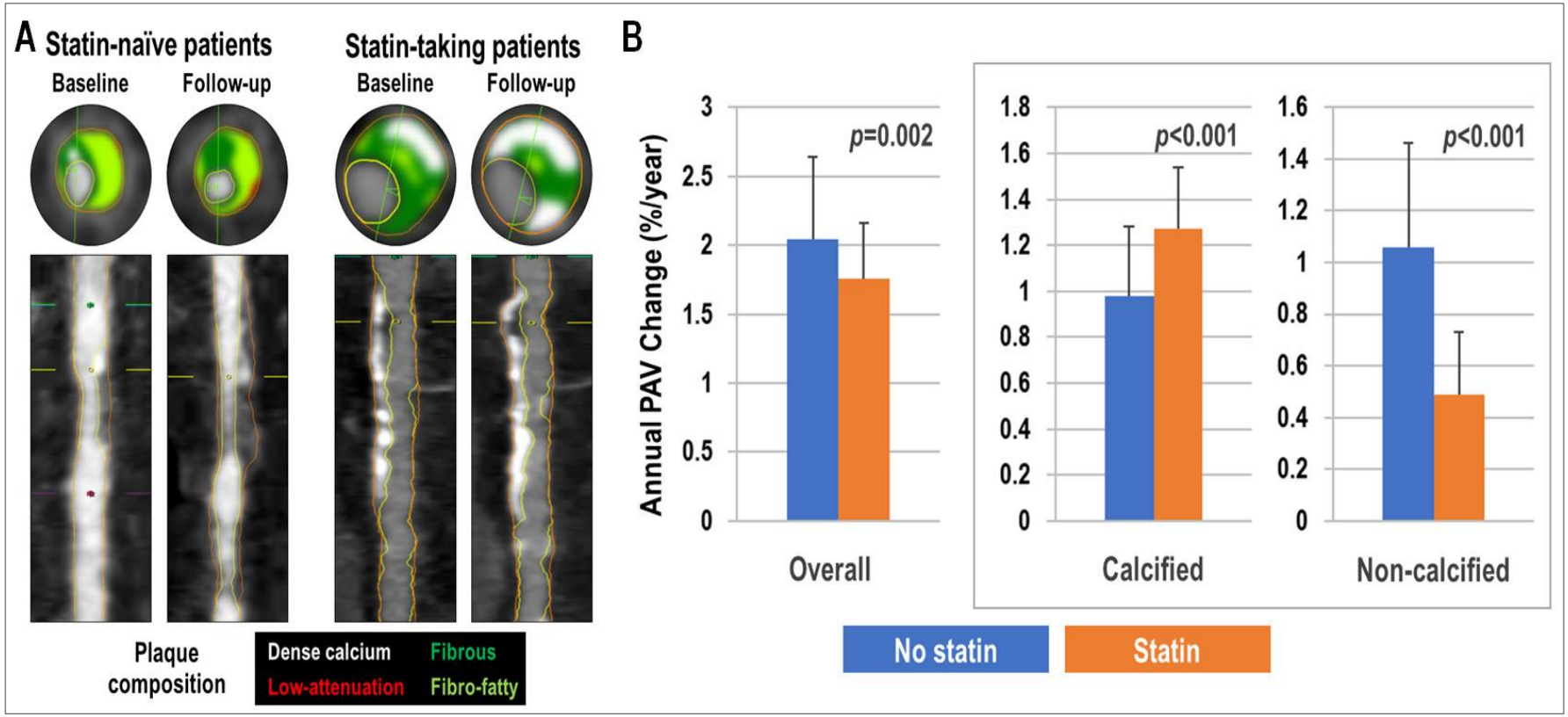
Effect of Statin on Coronary Atherosclerosis: PARADIGM

Temporal Change in Plaque Characteristics According to Statin Treatment



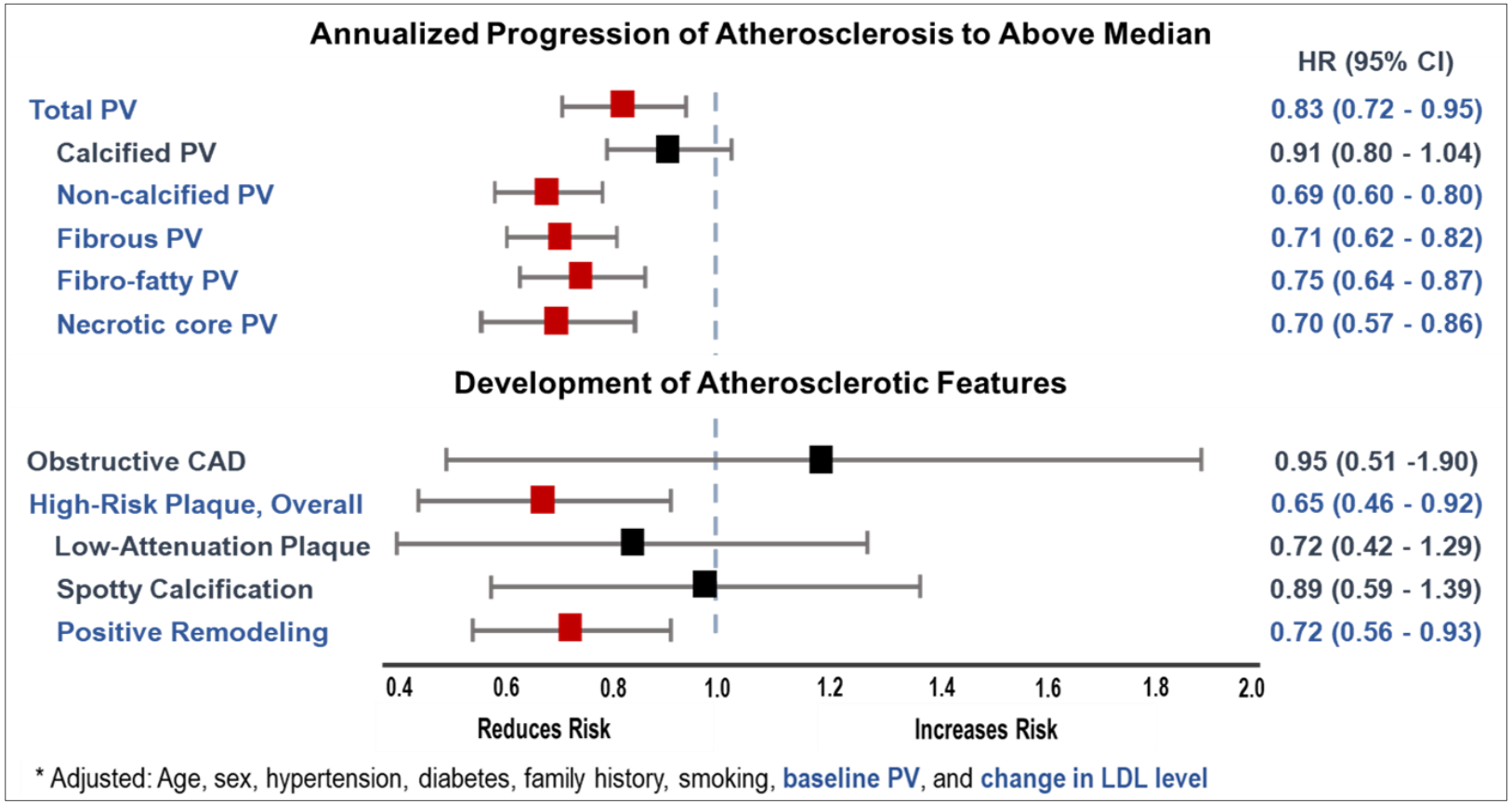
Effect of Statin on Coronary Atherosclerosis: PARADIGM

Annualized Change in Plaque Volume According to Statin Treatment



Effect of Statin on Coronary Atherosclerosis: PARADIGM

The Effect of Statins – Cox models: Multivariate Proportional Hazards



* Adjusted: Age, sex, hypertension, diabetes, family history, smoking, baseline PV, and change in LDL level

Conclusion

- In patients with suspected cardiac chest pain, coronary CTA per-se provides the function of
  - Diagnosis of CAD
  - Prediction of Event
  - Guidance to Proper Management
  - Tracking the Patients

  with non-invasive manner.

- Whether cCTA as a first diagnostic modality can improve outcomes in a cost-effective manner is to be yet determined, and will be further enhanced by various novel features of this imaging modality.

THANK YOU