

Non-invasive detection of coronary inflammation by computed tomography analysis of pericoronary fat enhances cardiovascular risk prediction in 3912 individuals

The CRISP-CT study



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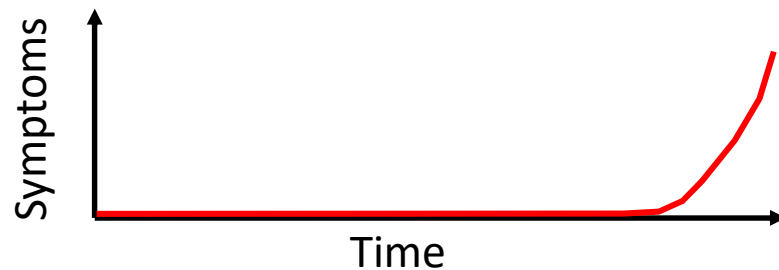
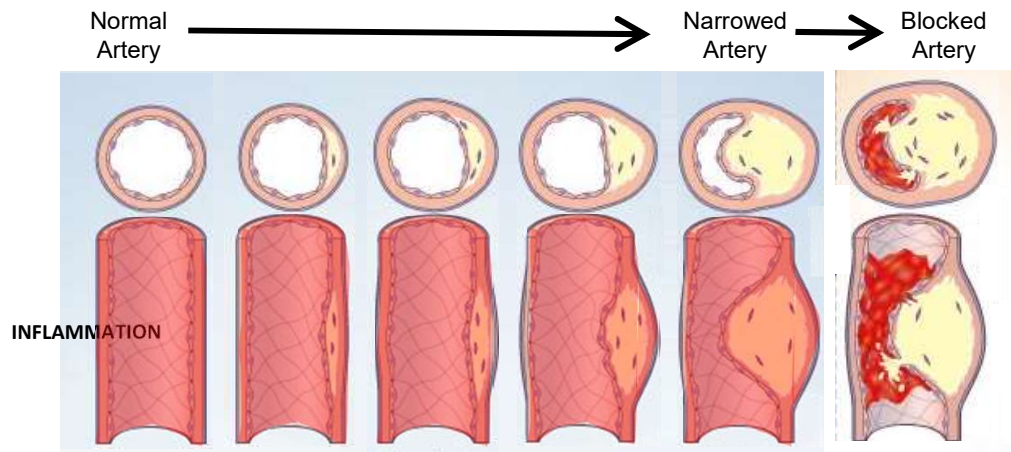
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Residual cardiovascular risk: the unmet need



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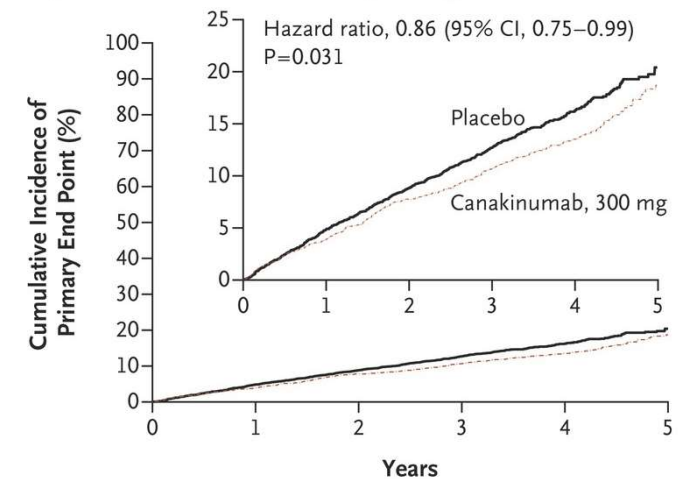
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Antiinflammatory Therapy with Canakinumab for Atherosclerotic Disease

Primary End Point with Canakinumab, 300 mg, vs. Placebo

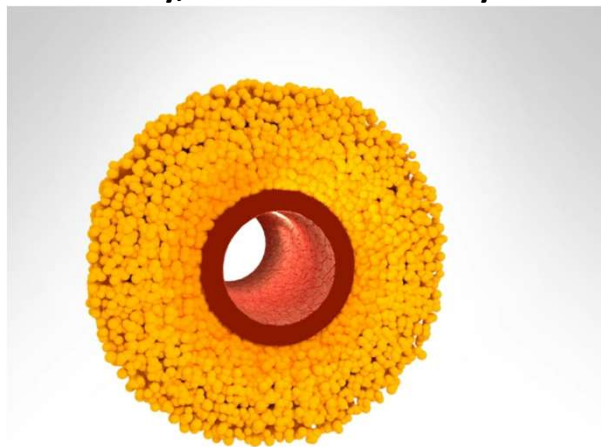


No. at Risk

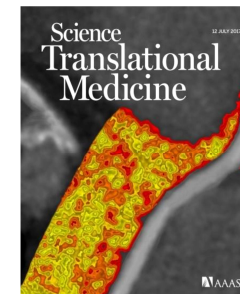
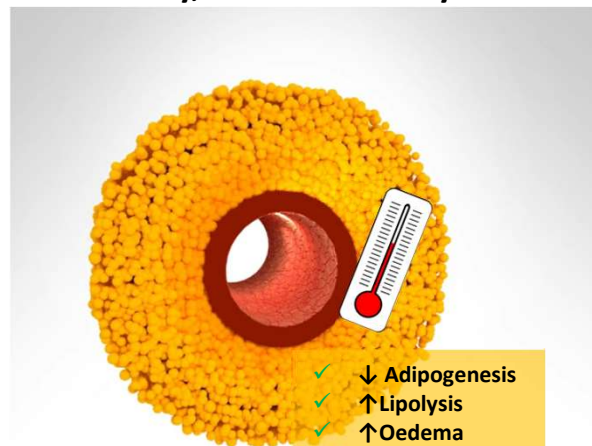
Placebo	3344	3141	2973	2632	1266	210
Canakinumab	2263	2149	2038	1819	938	199

Perivascular Fat Attenuation Index (FAI): Technology detecting coronary inflammation on CCTA

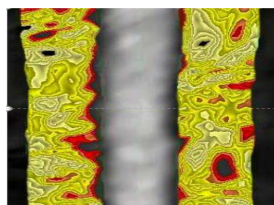
Healthy, **non-inflamed** artery



“Healthy,” **inflamed** artery



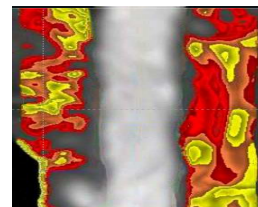
Low FAI



Healthy



High FAI



Heart attack 3y later

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Antonopoulos A et al. *Science Translational Medicine* 2017

Can FAI predict cardiovascular risk?

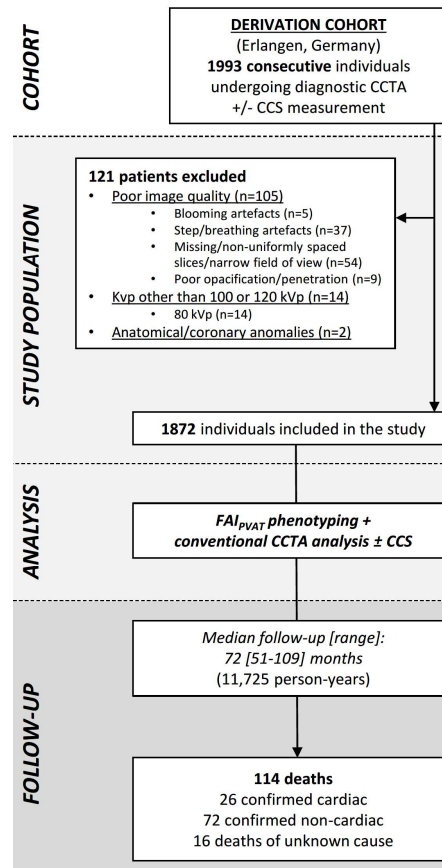
The CRISP-CT study



S Achenbach

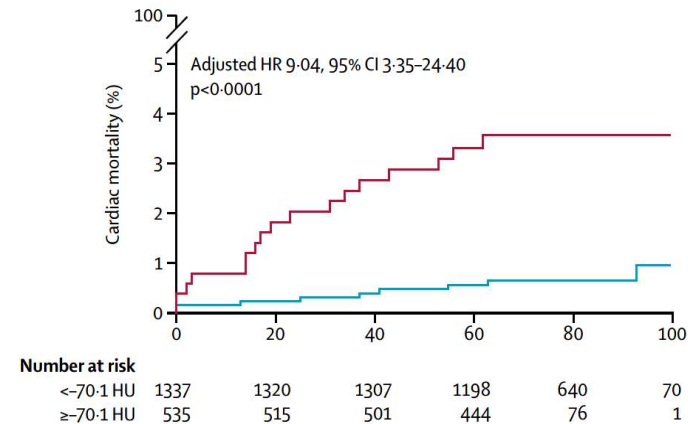
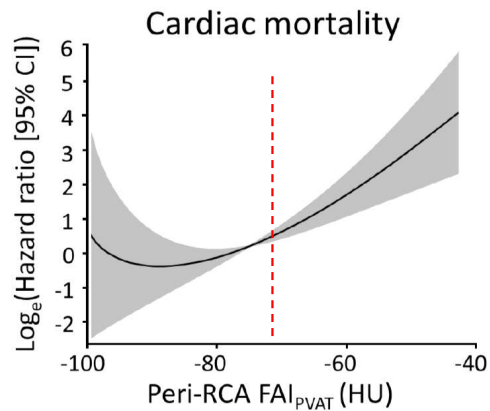
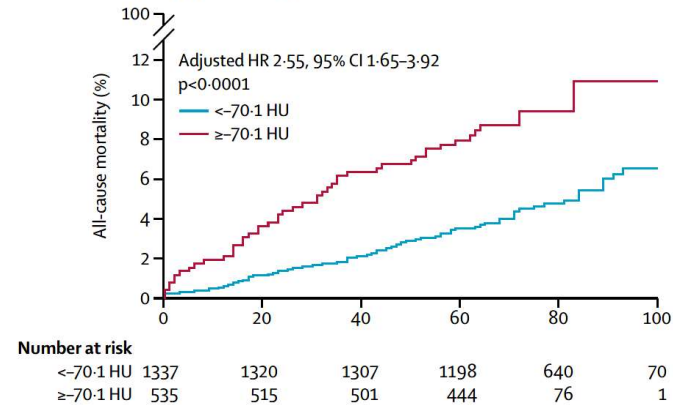
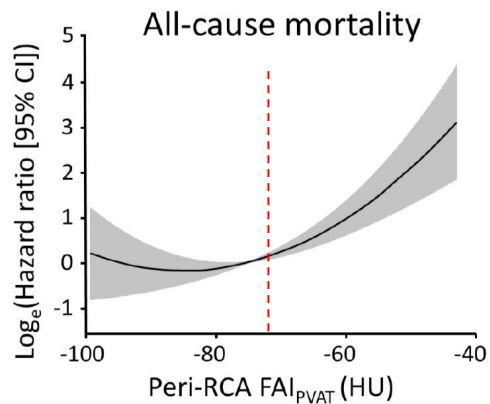


M Desai



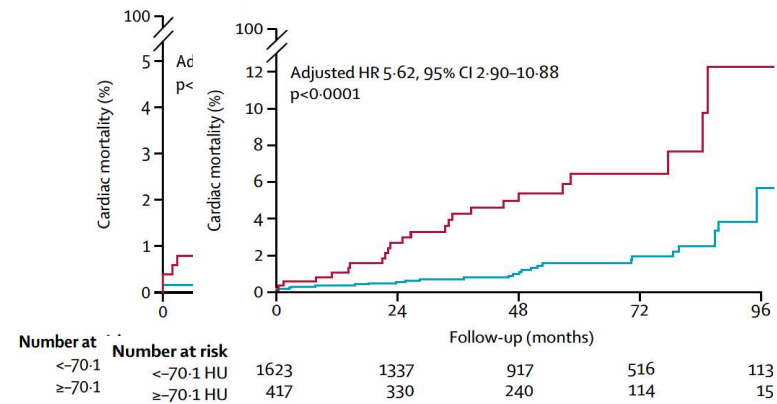
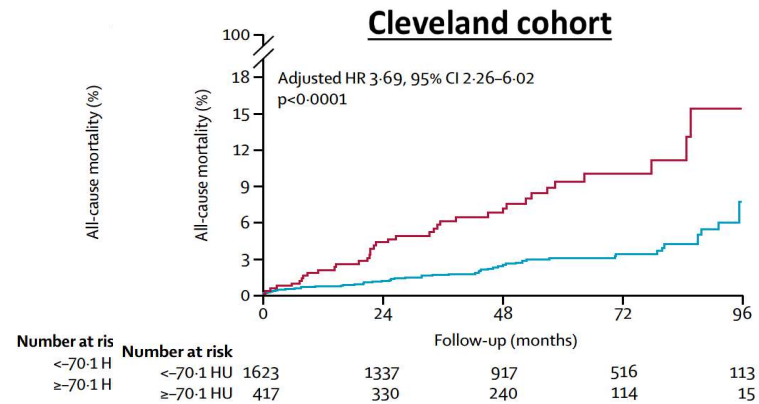
FAI has prognostic value in predicting cardiac death

Erlangen cohort

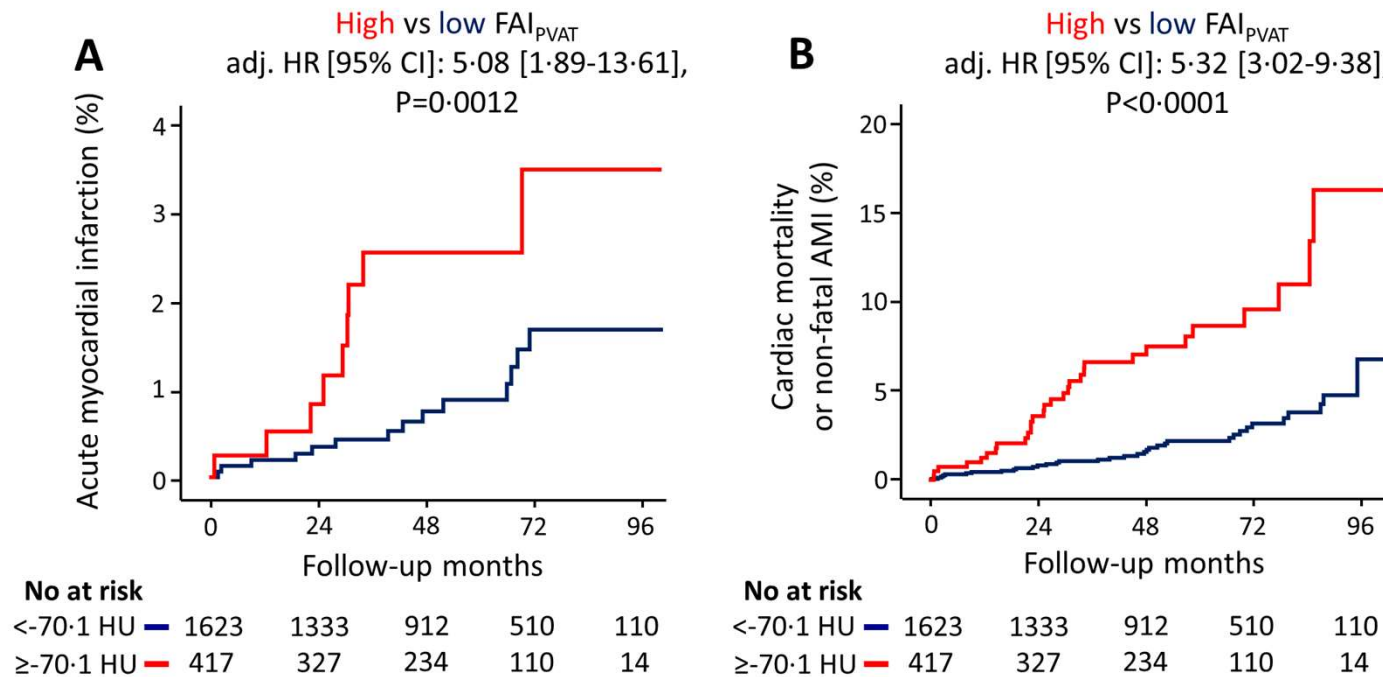


FAI has prognostic value in predicting cardiac death

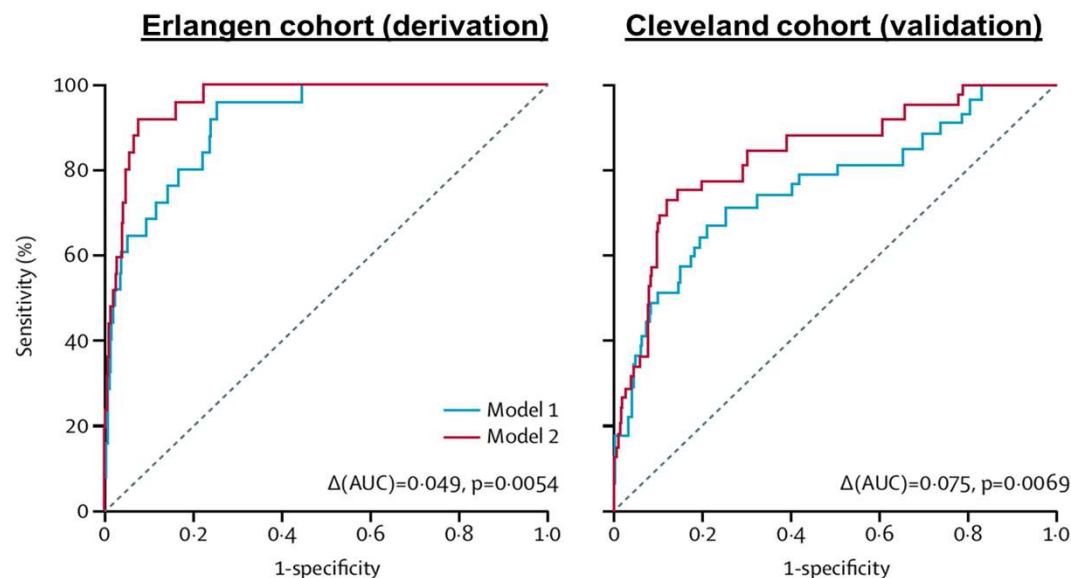
Erlangen cohort



FAI predicts non-fatal myocardial infarction



FAI improves prediction of cardiac death over and above current state-of-the-art



— **Model 1:** age, sex, hypertension, hypercholesterolaemia, diabetes mellitus, smoker status, epicardial fat volume, modified Duke CAD index and number of high-risk plaque features on CCTA.

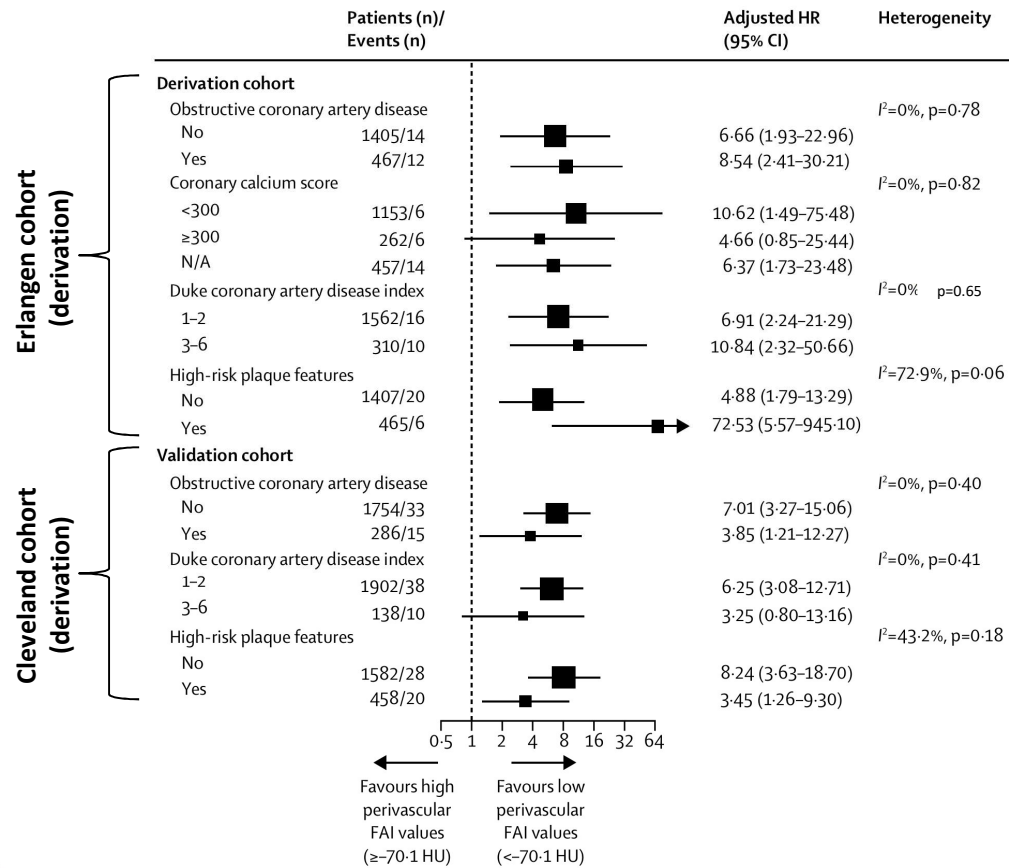
— **Model 2:** Model 1 + FAI

Areas under the curve:

Derivation: 0.913 (95% CI 0.867–0.958) to 0.962 (0.940–0.983), $P=0.0054$

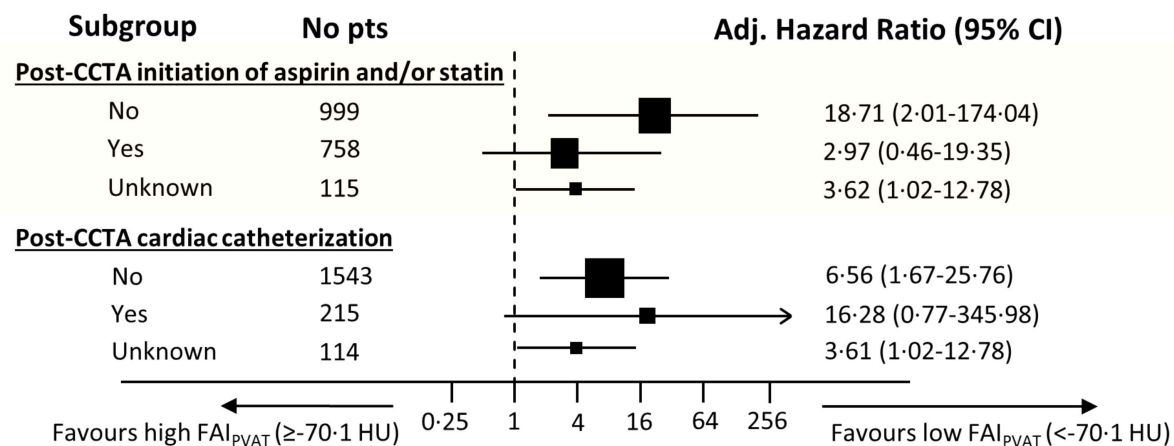
Validation: 0.763 (95% CI 0.669–0.858) to 0.838 (0.764–0.912), $P=0.0069$

FAI predicts cardiac mortality across all risk groups



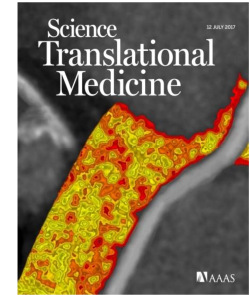
FAI may predict benefit from primary prevention in “low risk” individuals

Cardiac mortality prediction in Erlangen cohort, after treatment initiation



Risk for both groups together: Adjusted HR 9.04[3.35-24.4]

FAI: A powerful, novel technology for CV risk stratification



- ✓ Biology/Science: FAI is a novel index of coronary inflammation based on perivascular fat phenotyping
- ✓ Clinical value: FAI has a striking prognostic value for cardiac death and non-fatal AMI, over and above current risk scores and state-of-the-art interpretation of CCTA (risk modifiable?)
- ✓ Potential to use in clinical practice: The FAI technology is applicable to any standard CCTA, from any scanner and with any scan settings (with appropriate weighting)
- ✓ Pitfalls: FAI needs appropriate corrections for obesity, scanner type, scan settings and other technical factors, so crude measurement of “perivascular attenuation” is of limited value in clinical practice. Consistent and validated image analysis tools will allow quality-assured delivery of FAI technology for patient benefit.

Acknowledgments



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Health Research**



Caristo diagnostics
Advanced Solutions for Cardiovascular Risk Prediction

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Non-invasive detection of coronary inflammation using computed tomography and prediction of residual cardiovascular risk (the CRISP-CT study): a post-hoc analysis of prospective outcome data

Evangelos K Oikonomou, Mohamed Marwan*, Milind Y Desai*, Jennifer Mancio, Alaa Alashi, Erika Hutt Centeno, Sheena Thomas, Laura Herdman, Christos P Kotanidis, Katharine E Thomas, Brian P Griffin, Scott D Flamm, Alexios S Antonopoulos, Cheerag Shirodaria, Nikant Sabharwal, John Deanfield, Stefan Neubauer, Jemma C Hopewell, Keith M Channon, Stephan Achenbach, Charalambos Antoniades*



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FAI leads to significant risk reclassification

	Model performance		Discrimination (IDI [95% CI])	Risk reclassification				
	Change in χ^2	p value*		Events		Non-events		NRI (95% CI)
				Risk up	Risk down	Risk up	Risk down	
Cardiac mortality								
Derivation	20.29	<0.0001	0.038 (0.000–0.174)	0.64	0.36	0.17	0.83	0.94 (0.07–1.34)
Validation	25.30	<0.0001	0.032 (0.001–0.090)	0.56	0.44	0.20	0.80	0.72 (0.34–1.07)
All-cause mortality								
Derivation	16.54	<0.0001	0.017 (0.003–0.052)	0.48	0.52	0.19	0.81	0.58 (0.35–0.77)
Validation	25.60	<0.0001	0.030 (0.008–0.068)	0.51	0.49	0.21	0.79	0.60 (0.30–0.86)

Perivascular FAI comparison was ≥ -70.1 HU vs < -70.1 HU. IDI and NRI were calculated at 6 years. Baseline model (current state-of-the-art or model 1): age, sex, hypertension, hypercholesterolaemia, diabetes mellitus, active smoker status, epicardial adipose tissue volume, modified Duke coronary artery disease index (reference: group 1, mild or no disease), and number of high-risk plaque features. New model (model 2): model 1 plus high perivascular FAI values. FAI=fat attenuation index. IDI=integrated discrimination improvement. NRI=net reclassification improvement index. *Likelihood ratio test.