The association of the extent of myocardial infarction (MI) detected by magnetic resonance imaging (MRI) and the quantification of coronary calcium by computed tomography (CT)

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Background:
The ability to differentiate between viable and nonviable myocardium plays a critical role in the prognosis of patients with CAD. Contrast-enhanced cardiac MRI is superior to other currently available imaging procedures because it enables precise evaluation of wall motion disorders and the extent and localization of areas of myocardial infarction (MI). Calcium in the coronary arteries has been reported as a marker of artery disease and the risk for coronary events is associated with the quantity of coronary calcium.

Purpose of our study was to investigate the association of the extent of MI localized by gadolinium enhanced MRI, and the quantity of calcium in the coronary arteries detected with CT.

Methods and Materials: The study sample included 674 subjects (313 women, and 361 men, aged 68-93 years (mean 76)) from the AGES (Age, Gene/Environment Susceptibility) Reykjavik Study

Cardiac MRI

All cardiac MRI scans were performed with a 1.5 Tesla unit. For the assessment of global and regional left ventricular function, long axis, short axis and radial cine images were obtained with steady-state free precession (SSFP) sequence. Thereafter, gadolinium-enhanced MRI was acquired in the same image planes as the cine images using a delayed-enhancement inversion recovery imaging sequence.

All images were evaluated quantitatively and qualitatively by an experienced cardiac MRI observer for transmural or subendocardial MI.

Coronary artery CT imaging

A study dedicated research team used a 4 detector scanner and prospective ECG gating with 2.5 mm thick slices. The research team used the MESA coronary calcium scoring protocol to quantify coronary calcium as the Coronary calcium score (CCS).

The 17-segment model

The transmural or subendocardial extent of MI was localized using the 17-segment model. The same model was used to assess the distribution of calcium in coronary arteries that correspond to the 17 segments.

Results:
Of the 674 subjects examined, 139 (21%) had evidence of MI on MRI, 28% of all men and 14% of all women. Mean CCS (St. Dev.) for those without MI was 767 (range) for men and 362 (range) for women and for those with MI was 1555 (range) for men and 839 (range) for women (figure 1).
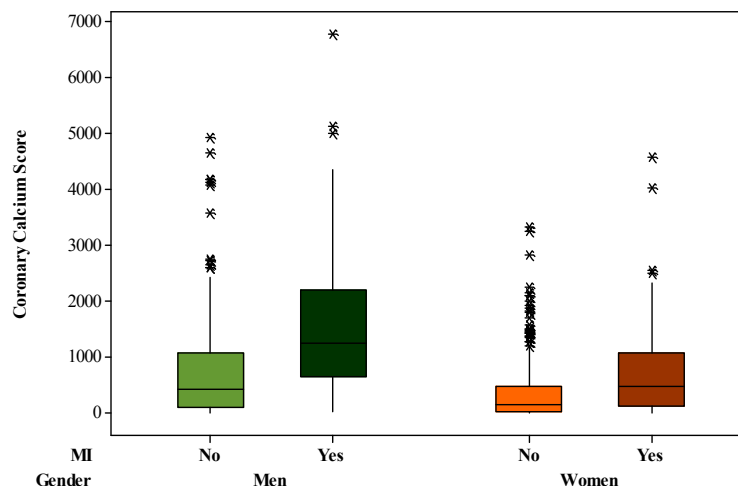

Figure 1. CCS for participants without (no) and with (yes) MI for both genders.

Of the 139 with evidence of MI, one subject (0,7%) had zero CCS and 26 (19%) subjects had CCS under 300. Subjects with MI in all three coronary distributions (n=32) had higher CCS, compared to those with MI in only one (n=69) coronary territory (p<0.05). Furthermore, those with only one or two infarcted segments (n=50) according to the 17-segment model had significantly lower CCS than those with infarct in three or more segments (n=89) (p<0.05).

Conclusion: The relationship between the extent of MI and quantity of coronary calcium is significant and strong. Patients with MI in all three coronary distributions have more calcium in the coronaries than those patients with fewer infarcted coronary territories and smaller infarcts