The Relations between Coronary Plaque Calcium Deposition and Vulnerable Plaques - Advanced Virtual Histology Analysis

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Background – The magnitude of coronary artery calcification (CAC) is associated with presence of atherosclerosis and predicts increased myocardial infarction and mortality rates. The potential mechanism linking CAC to cardiovascular events, however, have not been fully elucidated. Accordingly, we sought to investigate the relations between dense calcium deposition (DC) and major components of vulnerable plaque – the necrotic core (NC) area and thin cup fibroatheroma (TCFA).

Methods – We studied 50 non-MI patients with intermediate angiographic coronary artery stenosis (56.9% ± 15.2%). A dedicated, newly developed application was used to evaluate the plaque area and its component based on intravascular virtual histology (IVUS-VH) images (69 segments, 2735 slices). NC/DC ratio was defined as the ratio of necrotic core area to calcium. area.

Results – A significant correlation was noted between NC and DC deposition areas (r=0.7, p=0.0001). NC/DC ratio was similar in proximal reference, MLA and MaxNC sites (2.7±2.6, 3.0±3.8 and 3.2±4.3, p=NS). Interestingly, analysis of maxNC sites with and without VH-TCFA (high and moderate vulnerable plaques, respectively) suggests increased DC deposition in the more vulnerable sites (Table)

	MaxNC non-TCFA (n=43)	MaxNC TCFA (n=25)	P-value
IVUS analysis			
Luminal area (mm^2)	4.8 ± 2.2	4.9 ± 2.4	0.86
EEM area (mm^2)	14.6 ± 3.6	14.4 ± 4.1	0.85
Plaque Burden (%)	67.4 ± 11.9	64.4 ± 11.6	0.323
VH analysis			
Dense calcium (mm^2)	0.9 ± 0.8	1.2 ± 0.8	0.16
Dense calcium (%)	12.8 ± 10.1	19.1 ± 10.7	0.01
Necrotic core (mm^2)	1.7 ± 1.0	1.9 ± 1.2	0.46
Necrotic core (%)	25.3 ± 11.9	30.1 ± 8.6	0.08
NC/DC ratio	3.8 ± 5.3	2.0 ± 1.1	0.042

Conclusions – In coronary lesions of non-acute patients, DC is significantly correlated with the amount of NC. In addition, VH-defined high vulnerable sites contain increased amount of calcium. These observations may suggest that calcium, at least in certain patients, may predict worse cardiac outcome by being a marker for the presence of high vulnerable plaques.