Comparison of Culprit Lesions Showing Negative Remodeling Between Acute Coronary Syndrome and Stable Angina Pectoris

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Background: Previous intravascular ultrasound (IVUS) studies have shown that positive remodeling (RR) was associated with acute coronary syndromes (ACS), whereas negative remodeling (NR) is more common in stable angina pectoris (SAP). However, NR could be found in 30–50% of patients with ACS. The purpose of this study is to elucidate whether any differences are present at the culprit lesion showing NR in patients with ACS and SAP. Methods: Post-interventional IVUS images of 136 patients (98 ACS, 37 SAP) were identified. Remodeling ratio (RR) was defined as the ratio of external elastic membrane area at the culprit lesion to at the proximal reference. RR was defined as an RR > 1.05, negative remodeling as an RR< 0.95; and absence of remodeling (NR) as <0.95 and > 1.05. Results: In results in ACS group, NR was observed in 39 patients (39%), while in SAP group NR was found in only 7 patients (29%). In lesions showing NR, calcified plaques were more frequent in ACS (15%, SAP: 50%) but in ACS no calcification plaques were more common (ACS: 61%, SAP: 26%) (p<0.06). Moreover, patients showing NR in ACS were significantly younger than in SAP (p= 0.05). Conclusion. Differences in plaque morphology of NR between ACS and SAP may reflect different progression mechanisms of NR in ACS, eventually this may lead to acute coronary event.

In-Vivo Characterization of Plaque Morphology by Optical Coherence Tomography Predicts Coronary Artery Remodeling

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Background: The pathophysiology of remodeling and its relationship to plaque morphology are poorly understood. Positive remodeling is associated with acute coronary syndromes, whereas negative remodeling more commonly presents as stable angina. Optical coherence tomography (OCT) is a high resolution imaging technique capable of visualizing the plaque morphology in vivo. Hypothesis: Plaque morphology, characterized in vivo by OCT, predicts coronary remodeling. Methods: Intracoronary OCT imaging was performed with a 3.2 Fr OCT catheter. Intravascular ultrasound (IVUS) was performed with a 4.0Fr Atlantis catheter. At each site, the external elastic membrane (EEM) area was measured using IVUS and the plaque was characterized using OCT. The remodeling ratio (RR) was calculated as the ratio of the EEM at the culprit lesion to the EEM at the proximal reference. Positive remodeling was defined as an Rr > 1.05, negative remodeling as an RR< 0.95; and absence of remodeling as an RR between 0.95 and 1.05. Results: A total of 82 lesions were imaged in 50 patients. The results are shown in the table. Conclusion: The first in-vivo demonstration of the relationship between plaque morphology and arterial remodeling response, lipid rich plaque resulted in positive remodeling, suggesting the role of remodeling in plaque vulnerability.

Lipid Rich Plaque Mixed Plaque Fibrous plaque p value

Number 27 15 40
Positive 16 9 0 0.002
Remodeling 13 13 1 0.3
Negative 8 5 3 0.05
Remodeling 10 5 0 0.05
Remodeling Index 1.17 0.18 0.89 0.14 0.77 0.12 0.001

Detection of Thin-Capped Fibroatheromas in Human Aorta Tissue With Near Infrared Spectroscopy Through Blood

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Background: A method is needed to identify thin-capped fibroatheroma likely to cause acute coronary events in humans. We tested the ability of near-infrared (NIR) spectroscopy to characterize tissue through blood without spectral dilution. Methods: NIR spectra of human aortic tissue were acquired through whole blood at 38°C from 400 - 2500 nm using a 1/2 inch fiber optic probe. Probe-to-specimen depths were varied simulating in vivo parameters up to 1.5mm. Lipid rich aortic plaques were separated into three groups: disrupted, thin-capped, and thick-capped with average cap thicknesses of 231±29μ, 237±10μ, and 629±14μ, respectively. Partial least square -
discriminant analysis was used to create models using disrupted plaques with classification as the prediction mode. Results: The first model discriminated other plaque compositions from both thin-capped and thick-capped plaques (see Class Separation in Table) with excellent results. A second model was built that optimized the discrimination between the thin-capped and thick-capped plaques through variable depths. The model was also used to discriminate other tissue types with good results (see Fig 1 in Table). Better results were anticipated with a smaller probe illumination area. Conclusion: NIR spectroscopy can identify thin-capped plaques through blood with high sensitivity and specificity supporting the development of a NIR catheter to identify thin-capped fibroatheromas through blood in vivo in coronary arteries.