Geometrically-Correct 3D OCT: A Novel Imaging Method for the Identification of High-Risk Coronary Plaque

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Background
- Animal studies have shown that low endothelial shear stress (ESS) leads to high-risk plaque development
- The association of low ESS with high risk plaque characteristics has not been investigated in man

Purpose
We applied a new integrated imaging and functional assessment of the human coronary arteries to test the hypothesis that low ESS is associated with increased lipid core and thin fibrous cap

Methods
Study Population
Five culprit coronary arteries from 5 acute coronary syndrome patients were 3D reconstructed with geometrically-correct 3D OCT

3D OCT Reconstruction

ESS Calculation

ESS calculation on 3D OCT reconstructed arteries using CFD

Subsegments of Interest
The reconstructed arteries were divided into 3-mm long subsegments

Low ESS subsegments had larger lipid core and thinner fibrous cap as compared with high ESS subsegments

Results

Conclusions
- High-risk plaques with increased lipid core and thin fibrous cap develop in coronary regions with low ESS
- Calculation of local ESS in combination with fibrous cap thickness and lipid content derived from OCT may facilitate the early identification and prompt treatment of high-risk plaques