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**

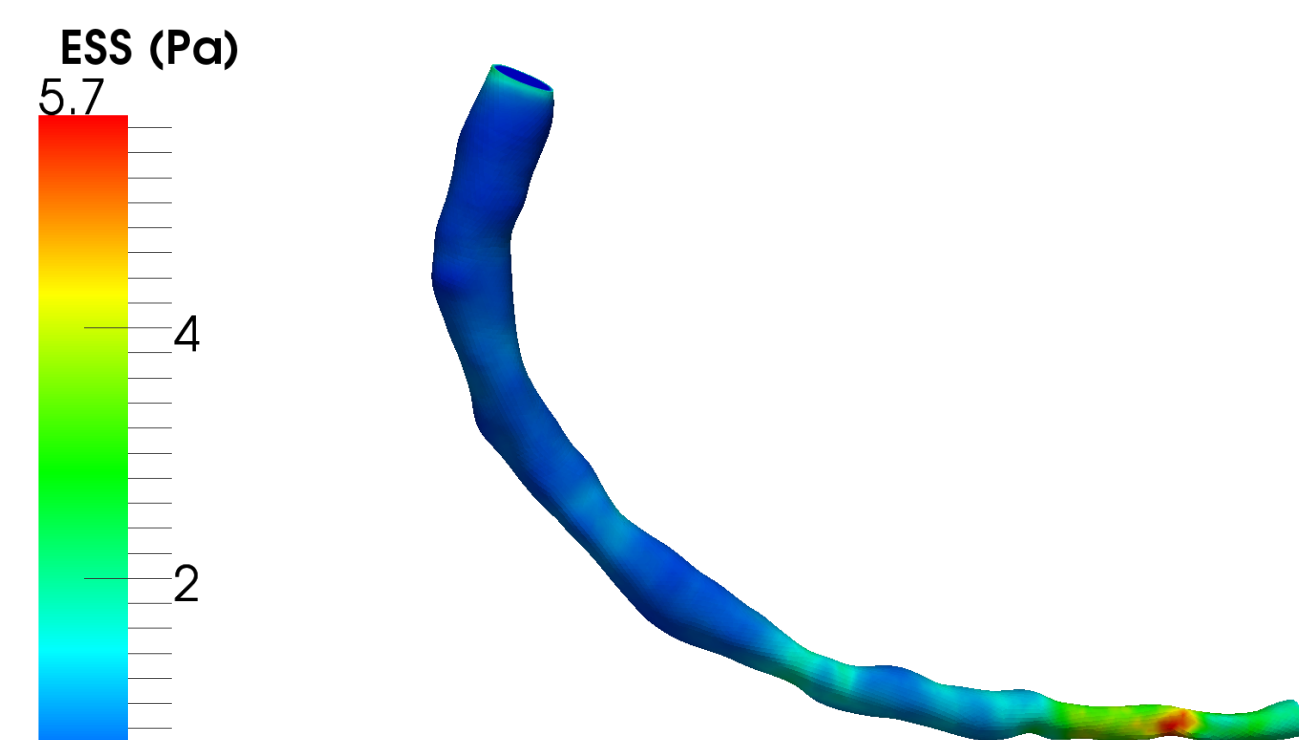## Methods

Study Population

Five culprit coronary arteries from 5 acute coronary syndrome patients were 3D reconstructed with geometrically-correct 3D OCT
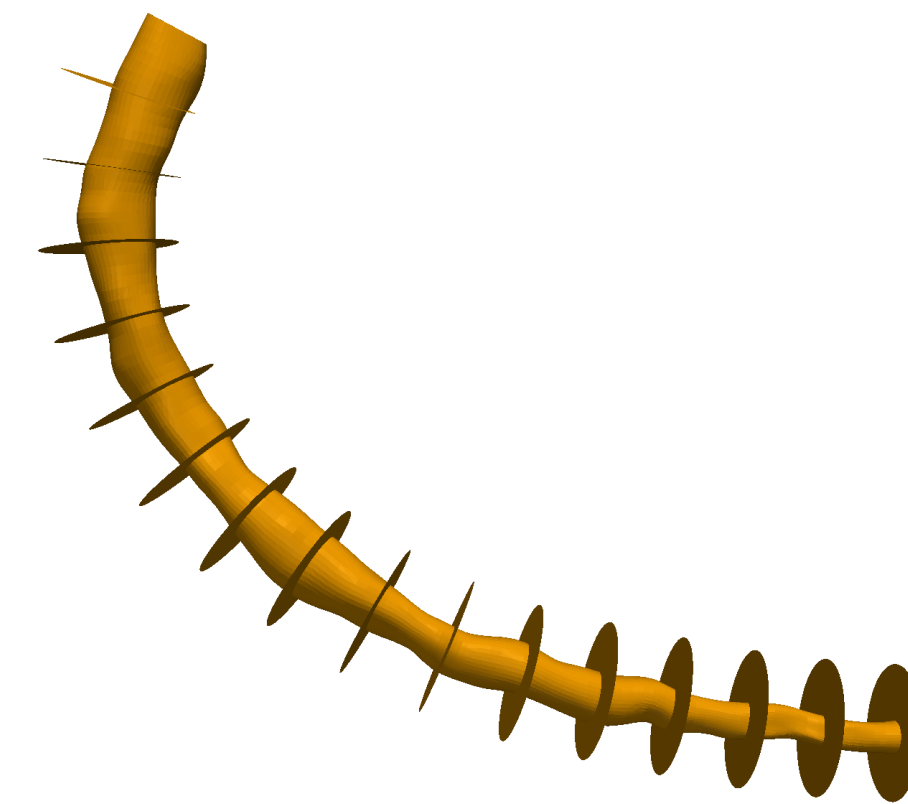
3D OCT Reconstruction
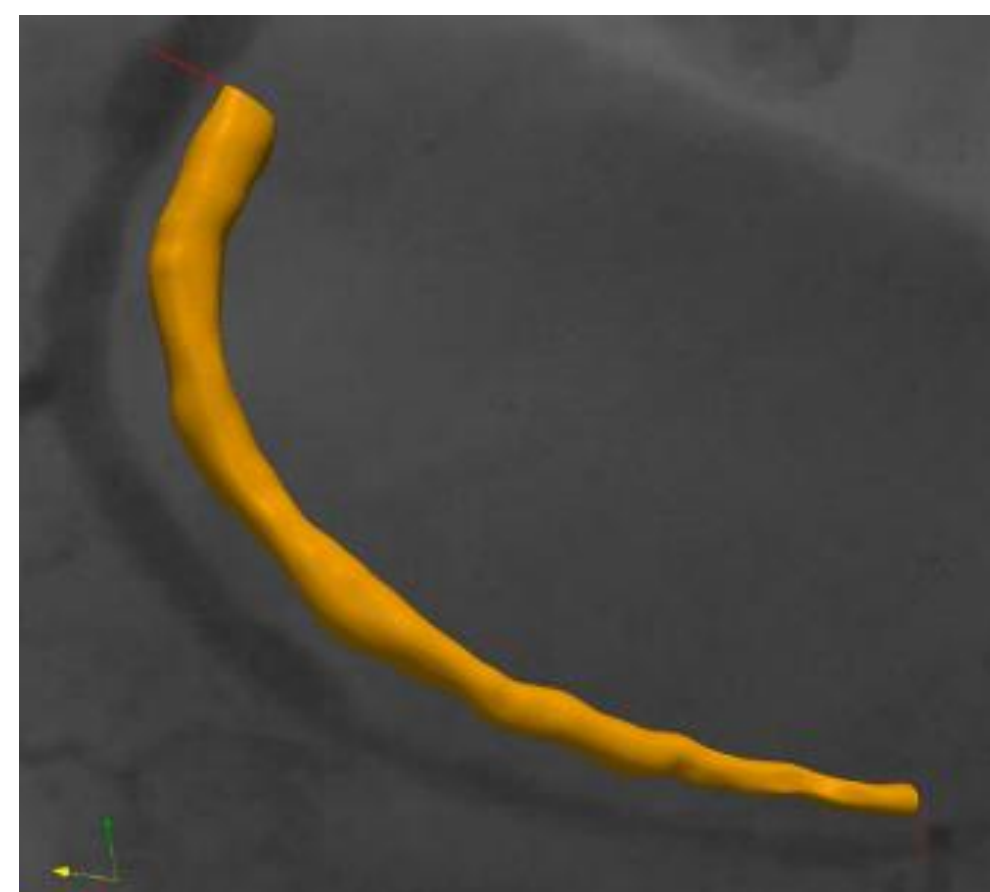
3D OCT reconstructed RCA

ESS Calculation

ESS (Pα)

ESS calculation on 3D OCT reconstructed arteries using CFD

Subsegments of Interest

The reconstructed arteries were divided into 3-mm long subsegments

Parameters Measured

- 51 subsegments were classified into low ESS (≤ 1.4 Pa) and high ESS (>1.4 Pa) categories

- A representative OCT cross-section was identified in each subsegment

- Minimum fibrous cap thickness and lipid core arc were measured in each OCT section

Results

High ESS — Lipid core, Thick cap

Low ESS — Thin cap, Lipid core
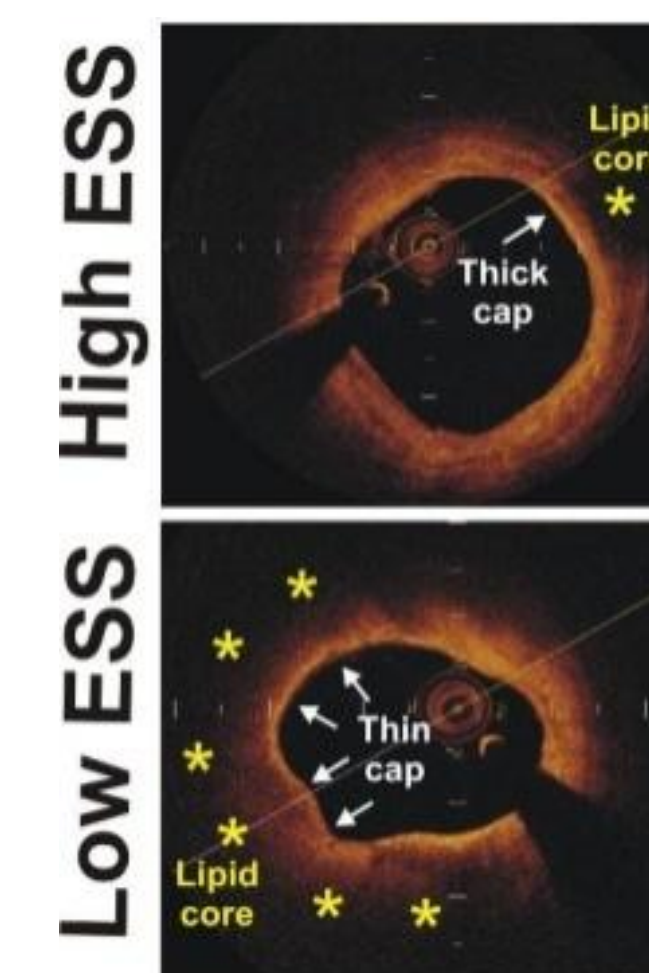
Low ESS subsegments had larger lipid core and thinner fibrous cap as compared with high ESS subsegments

Minimum cap thickness (μm) — p=0.05 — Low ESS, High ESS

Lipid core arc (degrees) — p=0.001 — Low ESS, High ESS
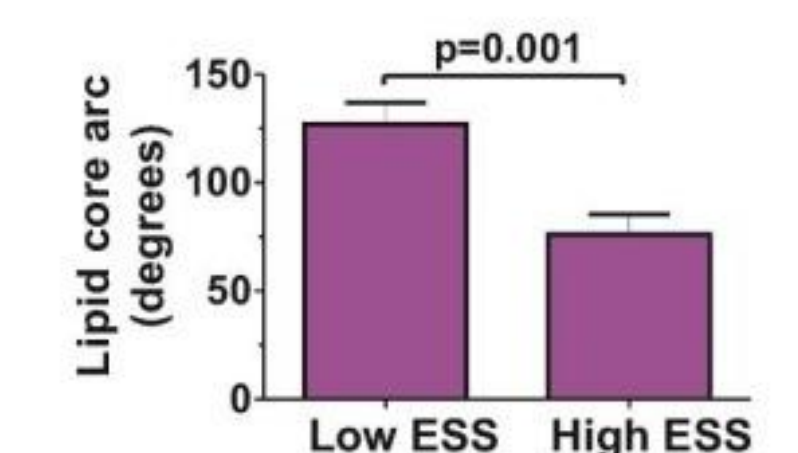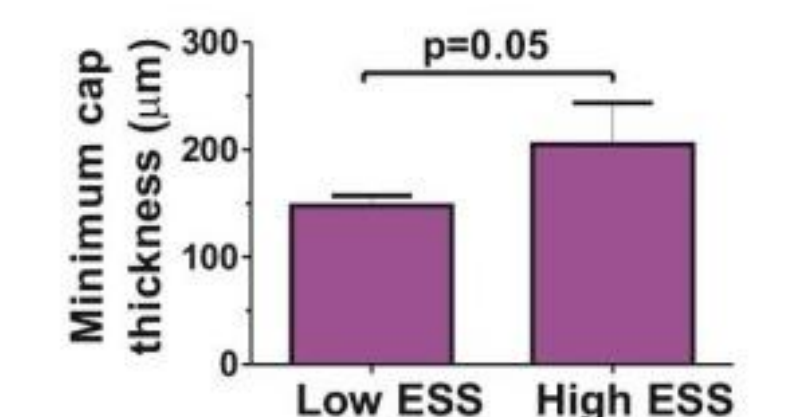
Conclusions

- **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