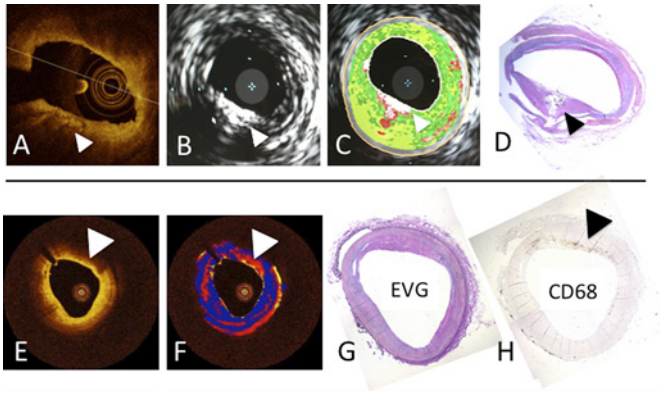


Abstract 023 Figure 2

## 024 VALIDATION OF TISSUE CHARACTERISATION AND VULNERABLE PLAQUE CLASSIFICATION USING VIRTUAL HISTOLOGY IVUS (VH-IVUS) AGAINST HUMAN POST-MORTEM HISTOLOGY

doi:10.1136/heartjnl-2012-301877b.24

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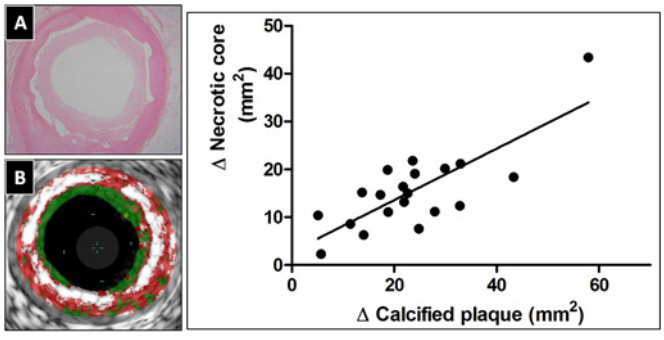
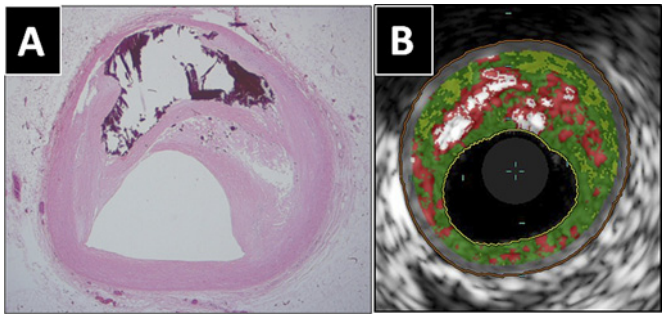
**Introduction** VH-IVUS is increasingly used in clinical trials to classify vulnerable thin-capped fibroatheroma (TCFA). However, VH-IVUS has not been validated for classifying coronary plaque against the gold standard of human post-mortem histology.

**Methods** Ten human coronary arteries were obtained at post-mortem. VH-IVUS examination was performed in a pressure-perfused system. The arteries were then fixed, stained and sectioned giving 72 co-registered 400 μm segments. Slides from each segment were examined by a histopathologist to determine the presence of calcification, necrotic core and to classify any plaque present. A fibroatheroma was considered a TCFA if fibrous cap thickness was <65 μm. VH-IVUS analysis was performed on each segment to compare tissue characterisation and plaque classification by an operator blinded to the histology. To explore a possible link between VH-IVUS detection of calcification and necrotic core artefact we also performed VH-IVUS of coronary segments in 20 patients pre- and immediately post-stenting to determine if there was a relationship between increasing calcium (simulated by stent struts) and necrotic core.

**Results** VH-IVUS was excellent at determining the presence of atherosclerotic plaque (sensitivity-100%, specificity-93%) and calcification (sensitivity-96%, specificity-90%) (Abstract 024 figure 1). Necrotic core was detected with a sensitivity of 100% but a specificity of 40%. For classification of a fibroatheroma by VH-IVUS (confluent NC >10% of plaque area for three consecutive frames) sensitivity was 87% and specificity-74%. Of the 24 segments wrongly attributed to contain necrotic core by VH-IVUS, 92% also contained calcium (67% contained >10% calcium). Stent struts are mistaken by VH-IVUS as calcification, surrounded by necrotic core not present on histology (Abstract 024 figure 2). Analysis of arterial segments pre- and post-stenting showed a linear correlation between increasing calcium (stent struts) with increases in necrotic core ($r^2$=0.61) suggesting some necrotic core surrounding calcium maybe artefact. VH-IVUS distinguished TCFA (fibroatheroma with core in contact with lumen) with sensitivity-71% and specificity-74%. As 65 μm is beyond the spatial resolution of VH-IVUS we repeated the analysis with caps <200 μm considered thin and the sensitivity of VH-IVUS to detect TCFA rose to 80%, specificity-76% (Abstract 024 table 1).




Abstract 024 Figure 1 (A) Post-mortem histology demonstrating presence of calcification and necrotic core with co-registered VH-IVUS (B) (necrotic core = red, calcium = white).




Abstract 024 Figure 2 Left : (A) Post-mortem histology demonstrated coronary segment with stent struts but no significant necrotic core. (B) Co-registered VH-IVUS image showing stent struts mistaken for calcium with necrotic core artefact. Right: Linear correlation between increase in calcified plaque and increase in necrotic core in coronary segments pre- and post-stenting.

Abstract 024 Table 1

| Histology defined plaque | Correctly classified by VH-IVUS |
|---|---|
| All Fibroatheroma | 26/30 (87%) |
| Calcified Fibroatheroma | 18/26 (69%) |
| Fibrocalcific | 9/24 (38%) |
| All TCFA (cap <65 μm) | 5/7 (71%) |
| Calcified TCFA (cap <65 μm) | 3/6 (50%) |
| All TCFA (cap <200 μm) | 8/10 (80%) |

**Conclusion** In comparison with histology, VH-IVUS reliably discriminated calcified plaque and detected necrotic core (classifying fibroatheromas) with good sensitivity. However, the specificity to detect necrotic core dropped in the presence of dense calcification due to necrotic core artefact. The sensitivity and specificity to detect TCFA was also limited by VH-IVUS spatial resolution.

## 025 FEASIBILITY OF COMBINED CARDIOVASCULAR MRI AND PERCUTANEOUS CORONARY INTERVENTION IN A HYBRID LABORATORY

doi:10.1136/heartjnl-2012-301877b.25

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**Background** The relationship between anatomy and associated pathophysiology in coronary artery disease (CAD) is complex and

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