

Small coronary calcifications are not detectable by 64-slice CT

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Small coronary calcifications are not detectable by 64-slice CT

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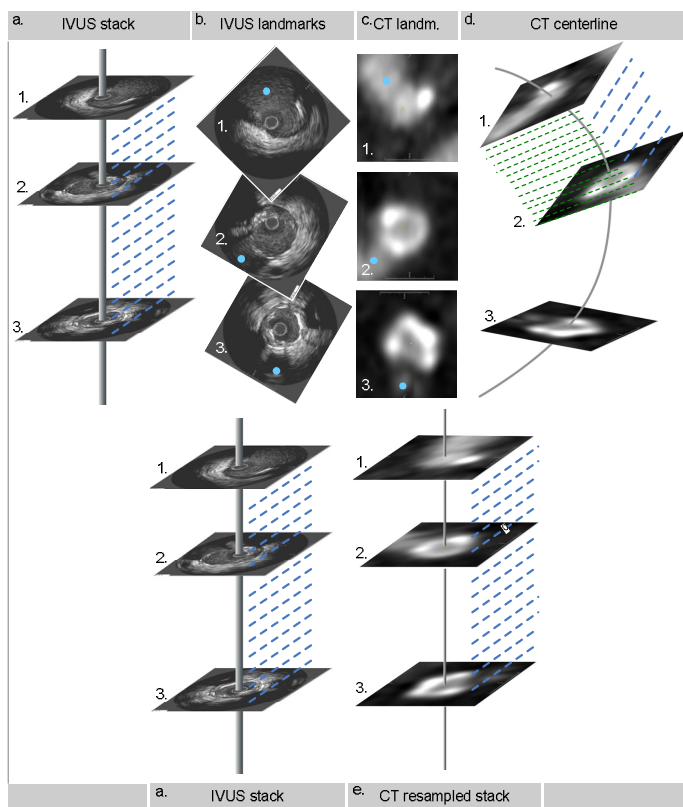
Background

Multi-slice computed tomography (MSCT) is a promising non-invasive tool for the assessment of plaque composition in coronary arteries. Calcium is one of the components that is frequently associated with plaque rupture. However, it is unknown to which extent calcifications can be detected with MSCT.

Aim: to compare the imaging of calcifications with MSCT to intra-vascular ultrasound (IVUS), the in-vivo gold standard for detection of calcifications.

Methods

The coronary arteries of patients with myocardial infarction or unstable angina were imaged by 64-slice MSCT angiography and IVUS. The MSCT and IVUS images were registered (fig. 1) and the arteries were inspected on the presence of calcifications on both modalities independently. We measured the length and the maximum circumferential angle of each calcification on IVUS.



Results

In 31 arteries, we found 99 calcifications on IVUS, of which only 47 were also detected on MSCT. The calcifications missed on MSCT were significantly smaller in angle ($27 \pm 16^\circ$ vs. $59 \pm 31^\circ$) and length (1.4 ± 0.8 vs. 3.7 ± 2.2 mm) than those detected on MSCT (fig. 2 and 3). Only calcifications larger than 2.1 mm in length or 36° in angle could reliably be detected on MSCT.

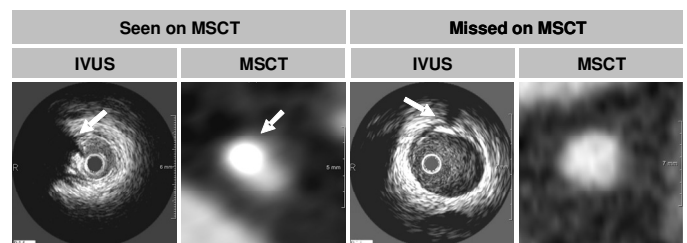


Figure 2: Examples of calcifications (arrows) on IVUS and MSCT.

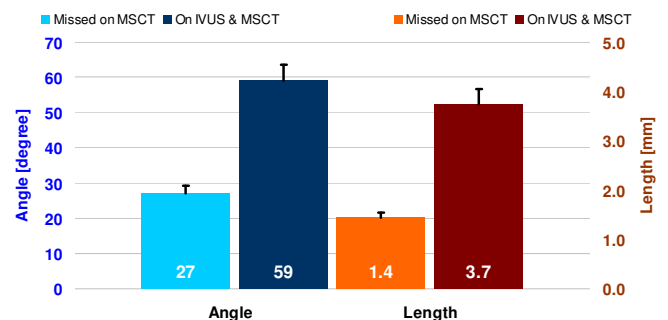


Figure 3: Properties of calcifications. The error bars indicate the SE.

Discussion

More than half of the calcifications were not visible on MSCT. The missed calcifications were smaller in length and angle. As small calcifications are associated with unstable plaques, the restricted local calcium detection by MSCT may have implications for rupture risk assessment of individual plaques.

Figure 1: Principle of the registration procedure. In the IVUS stack (a) 3 bifurcations (1 to 3) serve as landmarks (indicated by the dots in (b)) for the registration. In the MSCT scan the centerline is tracked through the artery and cross-sectional images are reconstructed (green dotted lines). The three bifurcations in the IVUS stack are identified in the MSCT cross-sections (c). The MSCT data is resampled between the landmarks such that the number of images between landmarks is equal to that in the IVUS stack (e).