Quantification of coronary artery stenosis with high-resolution CT in comparison with histopathology in an ex vivo study


PURPOSE
To investigate the ex vivo performance of high-resolution computed tomography (CT) for quantitative assessment of percentage diameter stenosis in coronary arteries compared to histopathology.

MATERIALS AND METHODS
High-resolution CT was performed in 26 human heart specimens after the injection of iodinated contrast media into the coronary arteries. Coronary artery plaques were visually identified on CT images and the grade of stenosis for each plaque was measured with electronic calipers. All coronary plaques were characterized by histopathology according to the Stary classification, and the percentage of stenosis was measured.

RESULTS
CT depicted 84% (274/326) of all coronary plaques identified by histology. Missed plaques by CT were of Stary type I (n=31), type II (n=16), and type III (n=5). The stenosis degree significantly correlated between CT and histology (r=0.81, p<0.001). CT systematically overestimated the stenosis of calcified plaques (mean difference 11.0 ± 9.5%, p<0.01) and systematically underestimated the stenosis of non-calcified plaques (mean difference -6.8 ± 10.4%, p<0.05), while there was no significant difference for mixed-type plaques (mean difference -0.4 ± 11.7%, p=0.85). There was a significant underestimation of stenosis degree as measured by CT for Stary II plaques (mean difference -14 ± 9%, p<0.01) and a significant overestimation for Stary VII plaques (mean difference 9 ± 10%, p<0.05), but there was no significant difference in stenosis degree between both modalities for other plaque types.

CONCLUSIONS
High-resolution CT reliably depicts advanced stage coronary plaques with an overall good correlation of stenosis degree compared to histology, however, the degree of stenosis is systematically overestimated in calcified and underestimated in non-calcified plaques.