

Coronary Artery Plaque Imaging: Comparison of Black-Blood MRI and 64-MDCT

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Introduction: Previous studies have shown that black-blood MRI has the potential to assess coronary artery wall thickness and measure plaque burden (1). However, a systematic evaluation of coronary plaque morphology and components by MRI has not been performed so far. The purpose of this study was to evaluate the ability of black-blood coronary arterial wall MRI to identify and classify coronary artery plaques by comparing with 64-MDCT.

Methods: 15 patients (mean age 56±8 years, 9 men) with confirmed coronary artery plaques in the proximal or middle segments of coronary arteries by 64-MDCT underwent black-blood coronary wall MRI within 10 days. All scans were performed on a 1.5T scanner (MAGNETOM Sonata, Siemens, Germany). Cross-sectional coronary wall images were acquired using a 2D double-inversion-recovery, ECG-triggered, navigator-gated, fat-suppressed, turbo-spin-echo (TSE) sequence (2) on the lesion coronary artery from the ostium to the middle segment continuously without gap. The following parameters were used : TR 2 R-R intervals, TE 31 ms, echo-spacing 6.12 ms, bandwidth 303 Hz/pixel, matrix 312* 384, field of view 400 * 325 mm², slice thickness 5 mm, navigator acceptance window ± 2.5 mm. The vessel cross-sectional area (CSA), luminal CSA, maximal wall thickness, plaque burden ((vessel CSA - luminal CSA) / vessel CSA), CNR ((SI vessel wall - SI perivascular tissue) / SD noise) and SNR (SI vessel wall / SD noise) were measured in each slice, which were then compared with CTA images. CTA images were divided into 5-mm segments to compare side by side with MRI.

Results: 3 patients were excluded from analysis (2 due to poor MR image quality, 1 due to claustrophobia). In 12 patients, coronary plaques were found in 46 slices on both CTA and MRI. These plaques were classified to 3 groups based on CTA: calcified plaques (n=11), soft plaques (n=23), and mixed plaques (n=12). In MRI, the plaque burden, maximal wall thickness, SNR, CNR in the coronary walls containing plaques were greater than those of the normal coronary walls (0.83±0.08 vs 0.73±0.08 , 1.88±0.51 vs 1.51±0.26 mm, 12.95±2.78 vs 9.93±2.31, 6.76±2.52 vs 3.89±1.54, respectively, p<0.05). The luminal CSA at the plaque was smaller than that at normal coronary walls (2.50±1.50 vs 4.72±2.28 mm², p<0.05). The SNR in the soft plaque was significantly greater than those in calcified and mixed plaques (p<0.05).

Conclusions: Coronary wall MRI can identify coronary plaques in the proximal and middle segments, and has the potential to differentiate plaque types based on signal intensity.

Reference

- (1) Miao C, et al. JACC 2009; 53:1708-1715.
- (2) Shea S, et al. Proc. ISMRM 2007; 15:2475.

