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Meeting abstract

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126 Comparison of coronary MR and CT angiography in detection of coronary stenosis with coronary calcification

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Introduction

Coronary CT angiography (CTA) with 64-slice CT has become a routine clinical test for patients with suspected coronary artery disease. However, the interpretation of CTA images is still limited by moderate and severe coronary artery calcification. Coronary MR angiography (MRA), on the other hand, does not suffer from beam hardening artifact by high density calcification and can potentially visualize the lumen of calcified coronary arteries.

Purpose

To compare the diagnostic performance of coronary MRA and CTA for detecting significant stenosis (>50%) in patients with high calcium score using conventional angiography (CAG) as a standard of reference.

Methods

Eighteen patients (12 men, 6 women; mean age 56 years; range 38 – 77 years) who had at least one calcified plaque with a calcium score > 100 underwent coronary MRA and CAG within two weeks of their CTA examination. There were no clinical events or medication changes recorded between examinations. Oral beta-blocker and sublingual nitroglycerine were used both in MRA and CTA studies. Coronary MRA was performed on a 1.5 Tesla scanner with an ECG-triggered 3D steady-state free procession sequence during free breathing. Coronary CTA and calcium score scan were performed on a 64-slice CT scanner. The severity of coronary artery stenosis was expressed as the percentage reduction in the luminal diameter determined by using quantitative coronary analysis (QAC) on CAG. Coronary MRA image quality of the calcified segments was assessed by two observers with consensus on a four point scale (1 = not visible, 2 = poor, 3 = good, and 4 = excellent) using a ten-segment model modified American Heart Association classification. The analysis of significant coronary stenosis was performed visually by three experienced radiologists who were unaware of the results of CAG. Each reader independently assessed the severity of coronary stenosis to be > 50% or < 50% at the site of each calcification on CTA and corresponding site on MRA. Receiver operating characteristic (ROC) curves were calculated for each reader using CAG as the gold standard.

Results

Thirty-three calcified plaques with a calcium score > 100 (mean calcium score, 257 ± 65, ranged from 101 to 813) were detected on CTA in the 18 patients. The coronary segments with nodal calcification (n = 17) showed higher image quality score than that of the segments with diffuse calcification (n = 16) (3.47 ± 0.62 versus 2.94 ± 0.77, $p < 0.05$). Of the 33 calcified coronary segments, 12 showed significant stenoses at corresponding sites of calcification on CAG. The sensitivity, specificity, and area under the ROC curve (AUC) for coronary MRA and CTA were: Reader 1, 75% (9/12), 81% (17/21), 0.85 versus 75% (9/12), 48% (10/21), 0.68; Reader 2, 83% (10/12), 71% (15/21), 0.87 versus 67% (8/12), 52% (10/21), 0.65; Reader 3, 83% (10/12), 71% (15/21), 0.86 versus 83% (10/12), 43% (9/21), 0.65. The average AUC for coronary MRA over the three readers was significantly higher than that for coronary CTA (0.831 versus 0.651, p = 0.030). The sensitivity values for each imaging technique were similar

among the three readers with P values > 0.05 (0.806 versus 0.750), except that for reader 1. The average specificity value for coronary MRA was significantly higher than that for coronary CTA (0.746 versus 0.476, p = 0.002).

Conclusion

Coronary MRA has higher image quality for the coronary segment with nodal calcification than that for the coronary segment with diffuse calcification. Coronary MRA has better diagnostic performance than coronary CTA for detection of significant stenosis in patients with high calcium score.