Meeting abstract

2010 Delayed enhancement of the coronary artery vessel wall in patients with coronary artery disease at 3.0 Tesla

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Background
Enhancement of the vascular wall after MRI contrast administration (Gd) has been reported in several inflammatory vasculopathies and in carotid atherosclerosis, where delayed enhancement (DE) has been associated with the plaque components, including the fibrous cap [1,2]. While no post contrast DE of the coronary vessel wall was found in young healthy adult subjects [4], coronary vessel wall DE has been reported in patients with coronary artery disease (CAD). All of these studies were performed at 1.5 T, a double or triple dose of Gd was injected, the time course of the process has not been well characterized [3,4] and as a result, MRI was performed up to 3 hrs after injection of the contrast agent [3].

Purpose
Because high-field coronary MRI may offer higher sensitivity and spatial resolution, we sought to use 3 T MRI for coronary vessel wall DE imaging after low-dose contrast injection, and to study the optimal time interval for DE coronary vessel wall measurements in patients with established CAD.

Methods
Eleven patients with a clinical history of CAD (5 male, 6 female, age 44–76 years, mean 61 ± 10 years) were studied on a 3.0 Tesla whole-body MR imaging system (Achieva 3 T; Philips, Best, The Netherlands). MR angiography of the right or left coronary artery system was performed with a navigator-gated free-breathing and cardiac-triggered, T2-prepared, three-dimensional, segmented k-space, gradient-echo imaging sequence after administration of 0.1 mmol/kg Gd-DTPA (Magnevist®, Berlex Laboratories, Montville, New Jersey, USA). T1-weighted inversion-recovery coronary MRI at the same anatomical level was then repeated up to 75 minutes after contrast administration. The data were analyzed after segregation into three time intervals: 30–45 (time 1); 45–60 (time 2) and 61–75 (time 3) minutes post-contrast. The magnitude of DE in the coronary arteries as well as in the ascending and descending aortic vessel wall was evaluated using a 3-point-scale (0 = no enhancement; 1 = mild to moderate enhancement; 2 = strong enhancement) and these categories were compared across different time-points using the Wilcoxon Rank SumTest. Coronary segments that were visible on the baseline T2Prep coronary MRA were analyzed for DE. Results are given as mean ± SD. Findings were compared using a 7-segment coronary artery model [5].

Results
Fifty-six of 62 (90.3%) visible segments by T2Prep showed coronary vessel wall DE at time 1 post-contrast. At time 2, 34 of 42 (81.0%) segments showed enhancement and at time 3, 29 of 39 segments (74.4%) were enhanced (Figure 1). The magnitude of coronary vessel wall DE was similar for all three intervals (time 1: 1.29 ± 0.64; time 2: 1.28 ± 0.80; time 3: 0.97 ± 0.71), although the enhancement at time 3 was significantly lower than that of time 1 (p = 0.028). In contrast, the average aortic wall enhance-
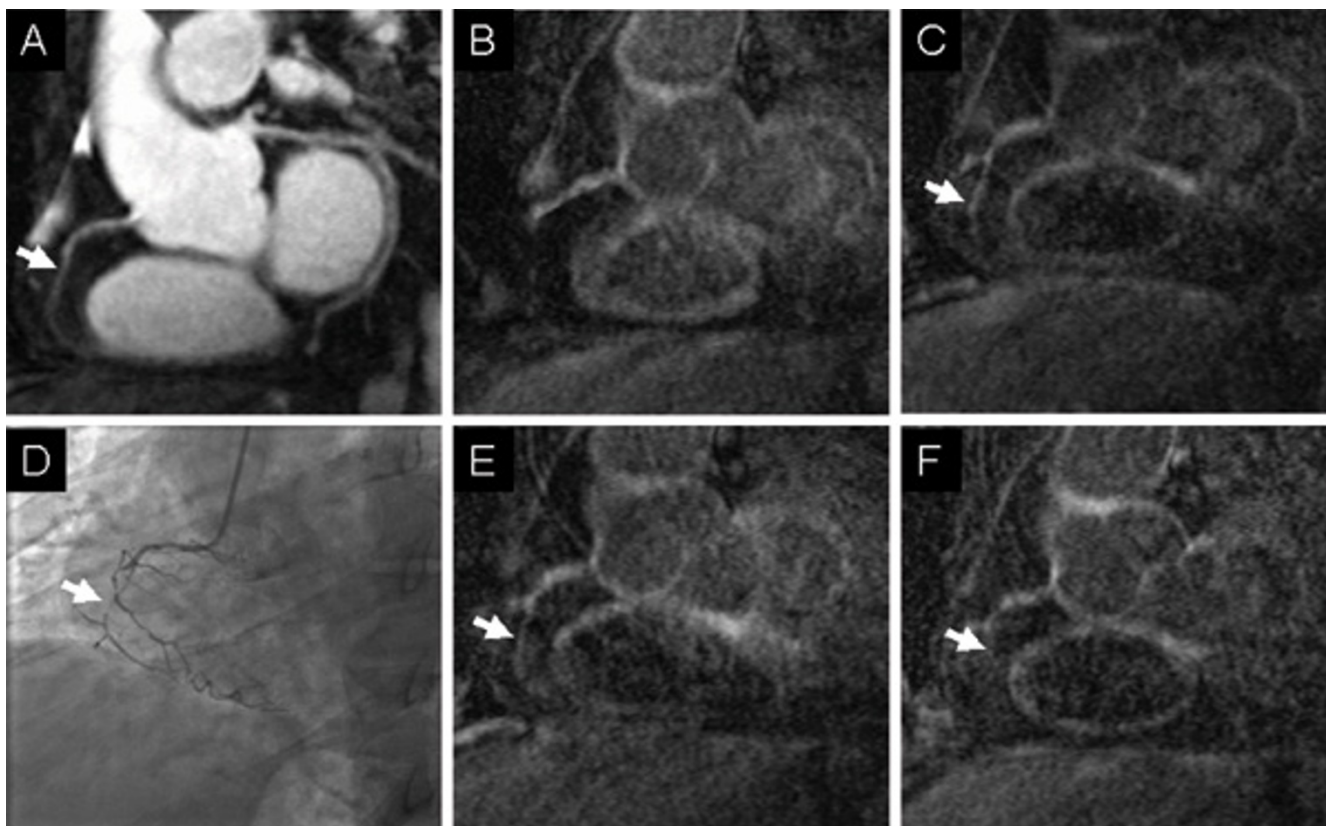
Figure 1
(A) MR-coronary angiography of the RCA (white arrow) showing intraluminal signal loss at medial and distal RCA as demonstrated by coronary angiography (D) (white arrow). Inversion recovery MR images, 42 min (B), 50 min (C), 60 min (E), 68 min (F) after contrast administration reveal strong enhancement at the earlist time-points and signal loss at the end of measurements (white arrows).

ment was similar among the three times (time 1: 1.50 ± 0.80; time 2: 1.81 ± 0.40; time 3: 1.81 ± 0.54) and did not differ significantly (p = n.s.) as a function of time post contrast. In Figure 1, a representative example obtained in a patient with x-ray defined right coronary artery (RCA) disease is shown. The T2Prep coronary MRA (Figure 1A) visualizes the coronary anatomy while DE of the proximal RCA is observed at four investigated timepoints.

Conclusion
3 T MRI and a low dose of Gd injection supports DE imaging of the coronary artery vessel wall in patients with documented CAD over a relatively long period of time. A substantial enhancement in the majority of the evaluated coronary segments was already found 30 min after administration of the contrast agent. This may have important implications for the design of MRI protocols that include post contrast imaging of the coronary artery vessel wall.

References
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