

# Diagnostic Performance of Non-Contrast Whole-Heart Coronary Magnetic Resonance Angiography Combined with Black-Blood Arterial Wall Imaging in Patients with Suspected Coronary Artery Disease

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**Introduction:** Whole-heart coronary MRA (WH CMRA) and black-blood coronary arterial wall imaging have been used independently to detect coronary artery disease (CAD) in previous studies [1,2]. However, the diagnostic performance of a combined approach hasn't been reported yet.

**Purpose:** To evaluate the diagnostic performance of combined non-contrast WH CMRA and black-blood arterial wall imaging in patients with suspected CAD.

**Methods:** Twenty patients with suspected CAD were scanned at 1.5T (MAGNETOM Sonata, Siemens, Germany). WH CMRA was acquired using a 3D ECG-triggered, navigator-gated, fat-suppressed, T2-prepared steady state free precession sequence. Cross-sectional coronary wall imaging (thickness = 5 mm) was performed using a 2D black-blood, ECG- and navigator-gated, fast spin-echo sequence with asymmetric adiabatic spectral inversion recovery fat suppression. Continuous slices without gap were positioned pre- and post- the suspected lesion segment perpendicular to the coronary artery obtained using multi-planar reformation of WH CMRA. All patients received selective coronary x-ray angiography (SCA) within 1 week before or after the MR examination. Image quality of CMRA and vessel wall images was evaluated on a segmental basis using a 4-point scale (1-not visible; 2-poor vessel delineation or severe motion artifacts; 3-good vessel delineation with minor artifacts; 4-excellent vessel delineation with no apparent artifacts). MR image analysis was performed by 2 radiologists who were blinded to SCA. Segments with a score of 1 in both techniques were excluded from analysis. A positive diagnosis of CAD was made when a stenosis  $\geq 50\%$  was detected in at least one of the techniques by visual analysis. Only left main (LM), proximal and middle segments of right coronary artery (RCA) and left anterior descending coronary artery (LAD) were included in our study. CAD was defined when a luminal diameter reduction of  $\geq 50\%$  is shown in SCA.

**Results:** 48 segments (M:F=15:5, 56 years on average) were included. The mean total scan times for WH CMRA and coronary wall imaging were  $12 \pm 0.7$  min and  $2 \pm 0.3$  min, respectively. 15 of 48 segments (12 of 20 patients) were diagnosed as CAD by SCA. On a segment-based analysis, average image quality of MRA and arterial wall imaging were 3.7 and 3.6, respectively. 2 out of 48 segments of wall images scored 1 because of rapid heart rate. MR results did not agree with SCA in 1 segment, potentially caused by high BMI (34.17) and irregular breathing. The sensitivities of MRA only and the combined MRA/vessel wall approach were 12/15 and 14/15, respectively, NPVs were (33/36) and (33/34). PPVs were (12/12) and (14/14), respectively. There was no difference in specificity (33/33) between the two approaches.

**Conclusions:** The combination of WH CMRA and black-blood coronary wall imaging improves the diagnostic accuracy of CAD over WH CMRA alone. A larger sample size is required to confirm the conclusion.

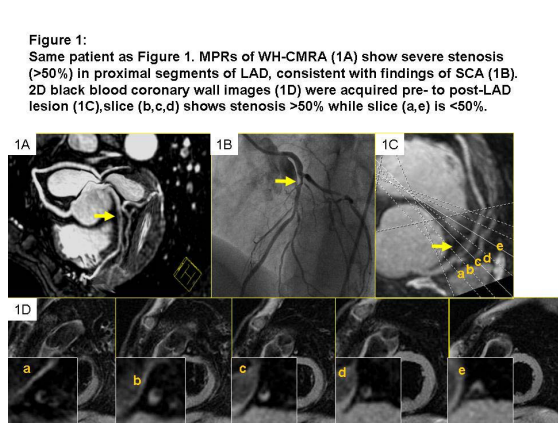


Figure 1: Same patient as Figure 1. MPRs of WH-CMRA (1A) show severe stenosis ( $>50\%$ ) in proximal segments of LAD, consistent with findings of SCA (1B). 2D black blood coronary wall images (1D) were acquired pre- to post-LAD lesion (1C), slice (b,c,d) shows stenosis  $>50\%$  while slice (a,e) is  $<50\%$ .

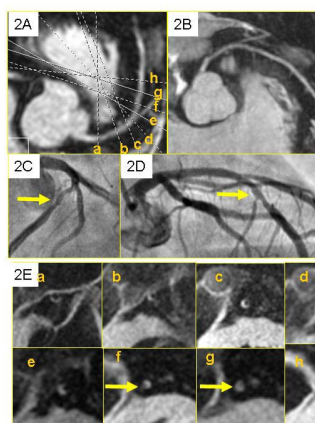


Figure 2. 62Y old woman with typical chest pain. MPRs of WH CMRA (2A,2B) without serious stenosis ( $<50\%$ ) in the proximal and middle segments of LAD, while SCA (2C,2D) indicate a 70-80% lumen stenosis of LAD middle segment (arrows). (2E) 2D black-blood coronary wall imaging were acquired along LAD as shown on MPR(2A). Slice (2E-f,g) shows stenosis  $>50\%$  which is consistent with the findings of SCA.

## References:

1. Yang Q et al. JACC2009;54:69-76.
2. Miao C et al. JACC2009;53:1708-1715.