Assessment of Coronary Artery Disease Using 3.0T Magnetic Resonance Coronary Angiography: A National Multicenter Trial

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Introduction: 3.0T contrast enhanced whole-heart coronary magnetic resonance angiography (MRA) is a promising method for noninvasive, radiation-free detection and exclusion of obstructive coronary artery disease (CAD); however, the accuracy of this approach has not been evaluated in a multicenter trial.

Purpose: This national multicenter study determined the diagnostic performance of 3.0-T whole-heart coronary MRA in patients with suspected CAD.

Methods: A total of 272 consecutive patients at 8 hospitals in China with suspected CAD referred for clinically indicated conventional X-ray coronary angiography were included in this prospective study. An ECG-triggered, navigator-gated, inversion-recovery prepared, segmented gradient-echo sequence was used for image acquisition. The accuracy of MRA for detecting a 50% diameter reduction was determined using X-ray coronary angiography as the reference method. Using an intention-to-diagnose approach, all coronary arteries were included for the evaluation regardless of the image quality of coronary MRA to avoid overestimation of the diagnostic accuracy. Clinical Trial Registration—URL: http://clinicaltrials.gov. Unique identifier: NCT01024478.

Results: Acquisition of coronary MRA was successfully completed in 235 of 272 (86%) patients with average imaging time of 9.5±1.6 minutes. The areas under the receiver-operator characteristic curve from MRA images according to vessel- and patient-based analyses were 0.90 (95% confidence interval [CI]: 0.88 to 0.95) and 0.88 (95% CI: 0.83 to 0.93), respectively (Figure 1). The sensitivity and specificity of MRA on per-patient basis were 91% and 80%, respectively. Example images are shown in Figure 2.

Conclusion: Among patients who were scheduled to conventional x-ray coronary angiography, we found that coronary MRA at 3.0T demonstrates high accuracy for detection of significant coronary artery stenosis. With contemporary techniques, 3.0T whole heart coronary MRA can be performed efficiently, and warrants greater consideration as a suitable noninvasive method to exclude obstructive coronary artery disease.

Reference: *1. Kim WY, et al. N Engl J Med. 2001;345:1863–1869. 2. Kato S, et al. J Am Coll Cardiol. 2010;56: 983–991. 3. Yang Q, et al. J Am Coll Cardiol, 54: 69-76, 2009. 4. Yang Q, et al. Circ Cardiovasc Imaging. 2012;5:573-579.*

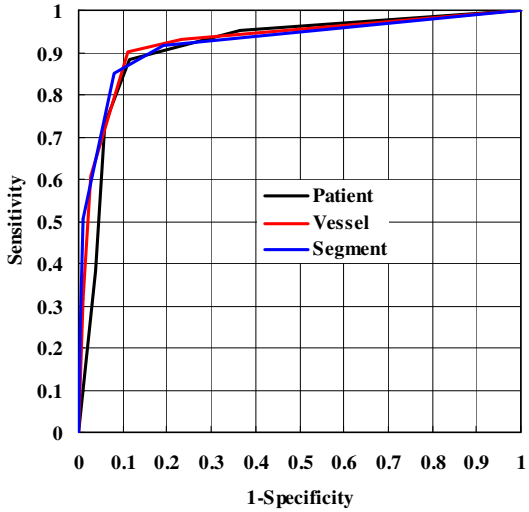

Fig. 1: The AUC of 3.0T contrast-enhanced whole heart coronary MRA for detecting significant coronary artery disease is 0.90 (95% confidence interval [CI]: 0.88 to 0.95) and 0.88 (95% CI: 0.83 to 0.93) on a vessel and patient based analysis, respectively. AUC = area under the receiver-operating characteristic curve; MRA = magnetic resonance angiography.

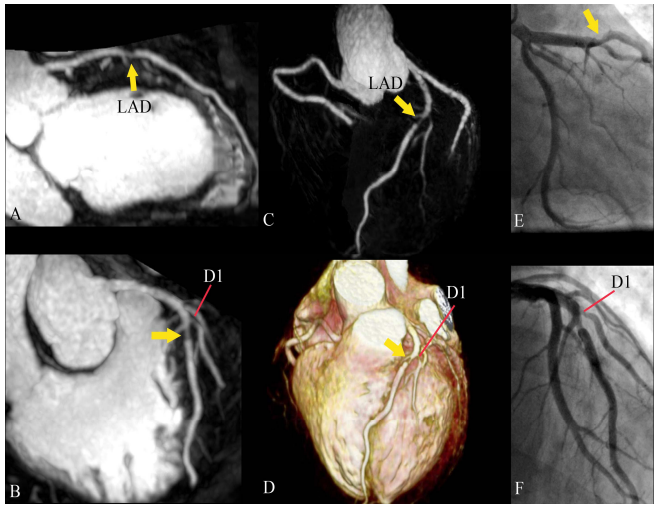

Fig. 2: Curved planar reconstruction (CPR) image (A), Sliding thin slab maximum intensity projection (MIP) image (B), MIP image of coronary tree (C), and volume-rendered image (D) detect coronary artery stenoses in the LAD (arrow) and first diagonal branch (arrowhead). Good agreement is observed between coronary MRA and X-ray coronary angiography.