

Combined coronary and late-enhanced viability imaging using 3.0T whole-heart coronary MRA for delineation of the etiology of left ventricular dysfunction

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Introduction: The major advantage of 3.0T whole-heart coronary MRA (CMRA) using a continuous gadolinium infusion is to combine lumenographic information and 3D myocardial viability in the same settings with patterns similar to those obtained by 2D-LGE (late Gd-enhanced) technique^{1,2}. This suggests a potential of this technique to assist in recognizing the etiology of patients with left ventricular dysfunction (LVD) which is essential for the risk stratification and treatment selection.

Purpose: To evaluate the feasibility and diagnostic accuracy of using combined coronary and delayed enhancement (DE) by 3.0T CMRA for determining the etiology of LVD.

Methods: Forty-two consecutive patients (29 males, 56±15 years) with LVD (ejection fraction: 39±12%) of unknown etiology underwent 3.0T coronary MRA(MAGNETOM Tim Trio, Siemens), 2D-LGE and CA. For coronary MRA image acquisition an ECG-triggered, navigator-gated, inversion-recovery prepared, segmented gradient-echo sequence was used. Imaging parameters included: voxel size 0.55x0.55x0.65 mm³ (interpolated from 1.1x1.1x1.3 mm³), TR/TE = 3.3/1.5 msec, flip angle = 20°, bandwidth = 700 Hz/pixel, TI=200 msec. Contrast agent (0.15 mmol/kg body weight, MultiHance, Bracco, Italy) was intravenously administered at a rate of 0.3 ml/sec. Patients were classified into four groups according to coronary artery disease (CAD) by CA and 2D-LGE patterns. Group 1: definite ischaemic LVD, patients with CAD and transmural or sub-endocardial 2D-LGE; group 2: non-ischaemic LVD, patients without CAD by CA and with no/atypical 2D-LGE; group 3: likely ischaemic LVD, patients with transmural 2D- but no CAD; group 4: likely ischaemic LVD, patients with CAD but no 2D-LGE. The diagnostic accuracy of coronary and DE on segmental basis was evaluated using CA and 2D-LGE as reference standards. Agreement between the four groups of patients was assessed using k-statistic.

Results: 3.0T CMRA was successfully completed in 39 of 42 (93%) patients. On per-patient basis, combined coronary and DE by 3.0T CMRA had excellent agreement with CA/2D-LGE to classify patients into the same four groups (k=0.86; P<0.01). Sensitivity, specificity and accuracy of 3.0T CMRA were 95.7, 93.8 and 94.8%, respectively for detecting patients with definite (group 1) or likely (groups 3 and 4) ischaemic LVD. Example images is shown in Fig 1.

Conclusion: The present study demonstrates that combined coronary and DE by 3.0T CMRA can identify the underlying etiology of patients with LVD in a manner much similar to 2D-LGE and CA. In this setting, integrating coronary and DE may be extremely useful for better understanding of the etiology of LVD.

Reference:1. Yang Q, Li D, et al. Proceedings of 18th annual ISMRM, Stockholm. 2. James A. White, et al. J Am Coll Cardiol Img, 2010; 3:921-930

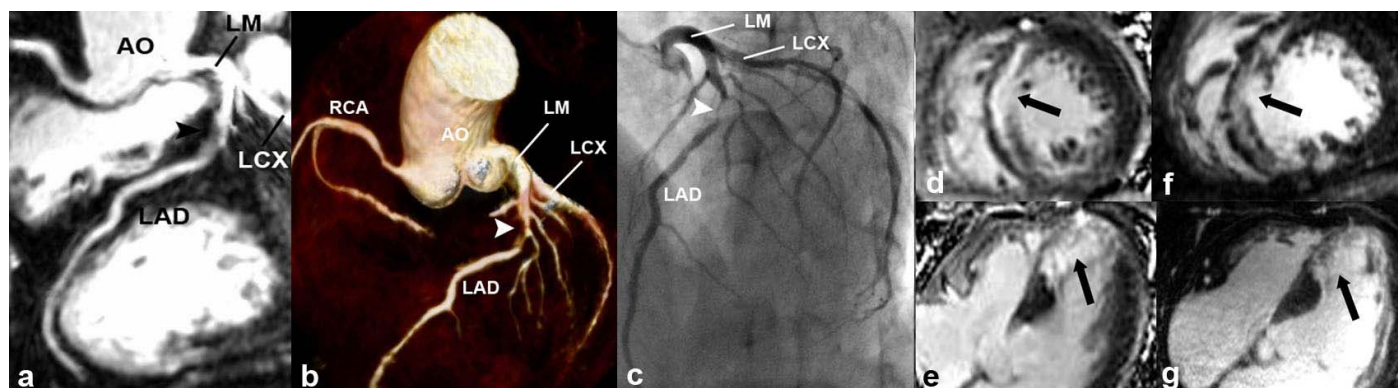


Fig. 1: 3T whole-heart CMRA of a 69 year-old ischaemic LVD patient. MIP and VR images (a,b) detects a significant LAD stenosis (arrow head) correlation with CA (c). Reformatted CMRA images (d,e) shows transmural LGE (black arrow) correlated well with 2D PSIR images (f,g)