

Contrast-Enhanced Whole-Heart Coronary MRA at 3.0T for the Evaluation of Cardiac Venous Anatomy

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Introduction:

In patients with congestive heart failure, pacemaker leads for cardiac resynchronization therapy (CRT) are placed in one of the tributaries of the coronary sinus (CS) system. Pre-implantation knowledge of the venous anatomy may help to decide whether transvenous LV lead placement for CRT is feasible. A recent study using navigator-gated, whole-heart steady-state free precession coronary MRA (CMRA) demonstrates that MR can depict the anatomy of the venous system at 1.5T (1). Contrast-enhanced whole-heart CMRA has been used to evaluate coronary artery disease at 3.0T (2). The purpose of the work is to assess whether contrast-enhanced whole-heart CMRA can be used to evaluate the coronary venous anatomy as well.

Methods:

Fifty-one subjects (45 patients and 6 volunteers; 26 men; age 59 ± 11 years) underwent contrast-enhanced whole-heart CMRA at 3.0T (MAGNETOM Tim Trio, Siemens) after written informed consent was obtained. Data acquisition was performed using ECG-triggered, navigator-gated, inversion-recovery prepared, segmented gradient-echo sequence with slow infusion of 0.15 mmol/kg gadobenate dimeglumine. A 32-element cardiac coil was used for data acquisition. Images were retrospectively analyzed and the visibility of the coronary veins was graded visually using a 4-point scale (1: poor – 4: excellent). The presence of the following cardiac veins was evaluated: CS, posterior interventricular vein (PIV), posterior vein of the left ventricle (PVLV), left marginal vein (LMV), vein of Marshall (VM), and anterior interventricular vein (AIV).

Results: Data from 3 subjects were discarded on the basis of poor image quality. The cardiac veins were visualized in all subjects. The mean distance of PVLV and LMV to the ostium of the CS was 3.00 ± 1.00 cm and 6.48 ± 1.14 cm, respectively. The mean score of PIV, PVLV, LMV, and AIV was 4.0, 3.4, 3.4, 3.0, and 3.3, respectively. The angle of the CS ostium was $59^\circ \pm 7^\circ$. Reconstructed image examples are shown in Figs.1 (normal) and 2 (variation).

Conclusions: Contrast-enhanced whole-heart CMRA at 3.0T can clearly depict the cardiac venous anatomy.

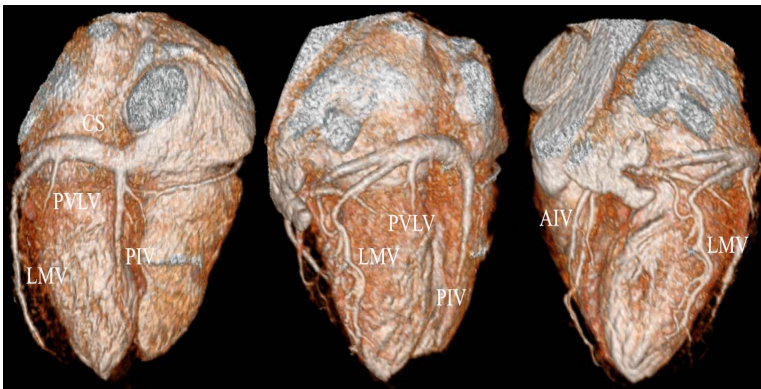


Fig. 1. Volume-rendered image provides an overview of cardiac venous anatomy and clearly depicts CS, PIV, PVLV, LMV and AIV.

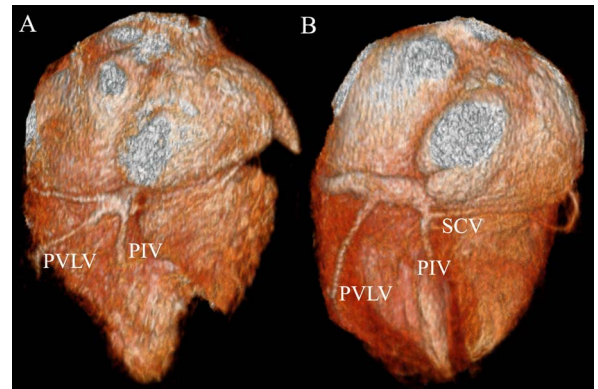


Fig. 2. (A) Volume-rendered image shows common origin of PIV and PVLV from the CS. (B) A new found anatomic variation: the SCV connected to the PIV and the PIV connected to the CS at the crux cordis.

References:

1. Yang Q, et al. J Am Coll Cardiol, 54: 69-76, 2009
2. Stoeck CT, et al. J Magn Reson Imaging, 29:1293-9, 2009