

Oral presentation

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## Magnetic Resonance (MR) Imaging of the cardiac venous system and MR-guided intubation of the coronary sinus in swine: a feasibility-study

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### Introduction

Procedures like cardiac resynchronization therapy (CRT) or percutaneous transcatheter mitral annuloplasty where improved 3-dimensional knowledge about cardiac and cardiac vein anatomy is needed may benefit from magnetic resonance (MR)-guidance.

### Purpose

The aim of this study was to visualize the coronary sinus using MR imaging and to demonstrate the feasibility of MR-guided intubation of the cardiac venous system (CVS) in swine.

### Methods

6 pigs were investigated. All experiments were performed using an interventional 1.5 Tesla MRI system. The CVS was visualized using an inversion-recovery navigator-gated whole-heart steady-state free precession sequence after administration of Gd-BOPTA contrast agent (130-150 slices, voxel size  $1.2 \times 1.2 \times 1.8 \text{ mm}^3$ , TR/TE 6.4/3.2, flip angle  $85^\circ$ ). Parallel imaging was used with a SENSE-factor of 2. The coronary sinus was then intubated under MR-guidance with a passive MR-compatible guidewire modified by incorporation of iron oxide markers for improved visualization and a non-braded Cobra-catheter. MR-guided interventions were monitored using a steady-state free precession real-time imaging sequence. Parameters of the real-time imaging sequence were TR/TE = 2.5/

1.25 ms, flip angle  $45^\circ$ , slice thickness 8 mm, matrix  $128 \times 128$  reconstructed to  $256 \times 256$  using zero-filling. Planning of the image planes, especially for the coronary sinus, were performed with the help of the wholeheart acquisition. Time needed was measured for MR-guided intubation of the CVS and compared to the time needed for fluoroscopy guided intubation of the CVS.

### Results

The CVS could be visualized in all animals (100%). The diameter of the ostium of the coronary sinus was  $7.6 \pm 0.75 \text{ mm}$  measured using the inversion-recovery 3-dimensional steady-state free-precession balanced wholeheart sequence. Intubation of the coronary sinus and its side branches was also feasible in all cases. Time spent for MR-guided intubation of the CVS was comparable to time spent for fluoroscopy-guided intubation ( $8.2 \pm 2 \text{ min}$  versus  $8.3 \pm 1.3 \text{ min}$ ;  $p = 0.92$ ).

### Conclusion

MR-visualization and MR-guided intubation of the coronary sinus and its side branches is feasible. The feasibility of MR-guided intubation of the CVS might have some relevance for procedures like CRT, requiring improved 3-dimensional knowledge about cardiac and cardiac vein anatomy as well as information about function, myocardial scar and asynchrony in the near future.