

Oral presentation

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## Noninvasive evaluation of coronary endothelial function by using 3 T phase contrast cine MRI

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### Introduction

The coronary vascular response to cold pressor test (CPT) is strongly dependent on the coronary endothelial function.

### Purpose

The purpose of this study was to evaluate the feasibility of coronary endothelial function test by using 3 T phase contrast (PC) cine MRI. Blood flow response to CPT was compared between coronary sinus (CS) and left anterior descending (LAD) coronary artery.

### Methods

Ten non-smoking male volunteers (averaged age  $29.6 \pm 4.9$ ) were studied by using a 3 T MR imager (Achieva) with 32 channel cardiac coils. Left ventricular (LV) mass was determined with balanced TFE cine MRI on short axis imaging planes encompassing the heart. Breath hold PC cine MR images of the CS were obtained in the resting state and during foot immersion in cold water (reconstruction voxel size =  $0.94 \times 0.94$  mm, FOV =  $240 \times 195$  mm, matrix =  $256 \times 256$ , TR/TE = 6.3 msec/3.8 msec, thickness = 5 mm.). Myocardial blood flow (MBF) was calculated as CS flow divided by LV mass. Flow response to CPT was also determined in the LAD artery by employing high spatial resolution PC cine MRI (reconstruction voxel size =  $0.82 \times 0.82$  mm, TR/TE = 7.3 msec/4.4 msec, PC velocity = 50 cm/sec). MBF and LAD flow during CPT were corrected by rate pressure product (RPP).

### Results

CPT test was well tolerated in all subjects, and 3 T MR imager provided excellent quality PC cine MR images of CS and LAD arteries in all subjects. The RPP significantly increased during CPT ( $7246 \pm 1274$  mmHg/min to  $8715 \pm 1442$  mmHg/min,  $p = 0.001$ ). In the resting state, MBF was  $0.90 \pm 0.25$  mL/min/g and LAD blood flow was  $28.5 \pm 6.8$  mL/min. Both MBF and LAD flow were significantly augmented during CPT (MBF:  $1.13 \pm 0.24$  mL/min/g,  $p = 0.037$ ; LAD:  $36.5 \pm 7.3$  mL/min,  $p = 0.017$ ). Good linear correlation and agreement were observed between the CPT response ratio of MBF and that of LAD flow ( $r = 0.71$ ,  $p = 0.022$ ).

### Conclusion

MBF and LAD flow in the resting state and during CPT can be readily quantified with high resolution PC cine MRI acquired with 3 T MR imager and 32 channel cardiac coils. Good agreement between CPT responses observed in CS flow and LAD flow in healthy volunteers indicated the reliability of this approach. CPT test using 3 T MR imager allows for an accurate and noninvasive evaluation of coronary endothelial function.