

# Assessment of Coronary Endothelial Dysfunction in Young Healthy Smokers using 3T Phase Contrast Cine MRI and Cold Pressor Test

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**Background:** Coronary endothelial dysfunction is observed in early state of atherosclerosis and has been assessed by measuring vasomotor response to acetylcholine infusion during coronary angiography, or by monitoring myocardial blood flow at rest and during cold pressor test (CPT) using <sup>15</sup>O-water and PET. Cigarette smoking is one of the risk factors of cardiovascular diseases and is related to coronary endothelial dysfunction. The purpose of this study was to evaluate the feasibility of measuring blood flow response to CPT in the coronary arteries using a 3T MR imager, and to determine the effect of smoking on coronary endothelial function in healthy young subjects.

**Materials and Methods:** Ten male non-smoking volunteers (averaged age: 29.6 ± 4.9) and age-matched six male smoking volunteers (smoking ≥ 5 years, 6.9 ± 3.1 pack-years, averaged age: 27.7 ± 2.7) with no evidence of heart disease or cardiovascular risk factors were studied with a 3T MR imager and 32 channel cardiac coils. Breath hold PC cine MR images of the LAD artery and coronary sinus (CS) were obtained at rest and during foot immersion in cold water (reconstruction voxel size=0.82 x 0.82mm, TR/TE=7.3/4.4msec, Venc =50cm/sec).

**Results:** CPT test was well tolerated in all subjects, and excellent quality PC cine MR images of the LAD artery and CS were acquired in all cases. In non-smokers, LAD flow was 28.5 ± 6.8mL/min and CS flow was 77.2 ± 22.1mL/min in the resting state. Both LAD flow and CS flow were significantly augmented during CPT (LAD: 36.5 ± 7.3mL/min, p=0.017; CS: 96.6 ± 19.1mL/min, p=0.007), with the CPT/rest flow ratio of 1.33 ± 0.38 in the LAD artery and of 1.32 ± 0.34 in CS. Good linear correlation was observed between the CPT/rest flow ratio in the LAD and that in CS (r=0.71, p=0.022), with a small mean difference of 0.013 by Bland–Altman analysis (95% limit of agreement; -0.53 to 0.56). In smokers, coronary blood flow in the resting state (24.7 ± 5.4ml/min in LAD) was not significantly different from that in non-smokers. However, the CPT/rest coronary flow ratio was significantly reduced in smokers in compared with non-smokers (0.86 ± 0.26 vs1.33 ± 0.38, p=0.02).

**Conclusion:** Coronary Blood flow response to CPT can be reliably quantified by using 3T PC cine MRI. The coronary endothelial function assessed by CPT was significantly impaired in young smokers compared with age-matched non-smokers. The results in the current study indicate that CPT test using 3T MR imager allows for non-invasive assessment of coronary endothelial dysfunction, and may be useful for detecting the early stage of atherosclerosis.

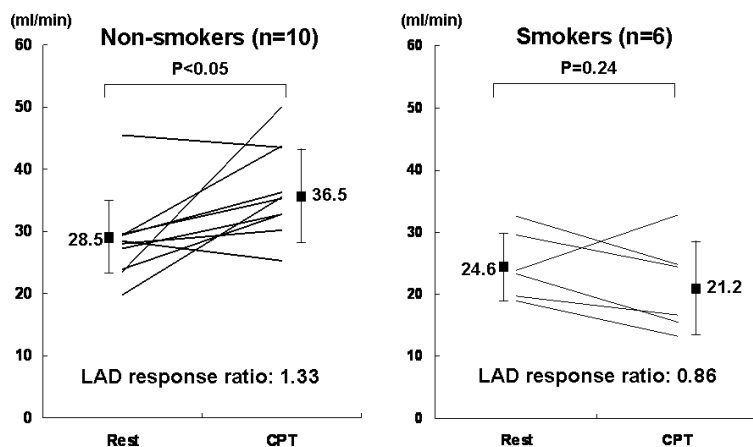


Figure 1. The LAD blood flow at rest and during CPT in non-smokers and smokers. The CPT/rest flow ratio was significantly decreased in smokers compared with non-smokers. (0.86 ± 0.26 vs1.33 ± 0.38, p=0.02).