# Stress Myocardial Perfusion MRI Using FIESTA in the Detection of Significant Coronary Artery Stenosis

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## Introduction:

Previous studies demonstrated that first-pass myocardial perfusion MRI during vasodilator stress permits noninvasive detection of flow-limiting stenoses in the coronary arteries. Perfusion MR sequence employing steady-state free procession has a potential to improve image contrast-to-noise ratio [1,2], however, subendocardial hypointensity artifact during first-pass of the contrast medium observed on steady-state perfusion MR images may leads to suboptimal diagnostic accuarcy in detecting significant coronary artery stenosis. Since the diagnostic peformance of steady-state perfusion MR sequence has not been fully evaluated, the purposes of this study were to evaluate if steady-state perfusion MR sequence (FIESTA) can provide improved image quality in comparison with a conventional perfusion MR sequence using a hybrid echo-planar approach, and to determine the diagnostic performance of stress perfusion MRI using FIESTA in detecting significant flow-limiting stenoses in the coronary arteries.

## Methods:

Forty-one patients (mean age 65+/-10 years) with suspected coronary artery disease were evaluated with a 1.5 T MR system (Signa CV/i, GE Medical Systems, Waukesha, WI). First-pass myocardial perfusion MRI was performed during ATP stress and in the resting state by using FIESTA (Fast Imaging Employing Steady-state Acquisition) perfusion sequence (TR 3.0ms; TE 1.2ms; TI 180ms; flip-angle 45 degrees). Thirty dynamic MR images were acquired every 2RR intervals on 6 short-axis slices of the LV with a rapid injection (4ml/sec) of 0.05mmol/kg of Gd-DTPA followed by 20ml saline flush. X-ray coronary angiography was performed in all patients within 2 weeks of MR study. Stenosis of 70% or more of the luminal diameter in the coronary artery was considered to be significant. The contrast-to-noise ratios at peak contrast enhancement in normally perfused myocardium were calculated on FIESTA perfusion MR images and conventional perfusion MR images (gradient echo sequence with echo planar readout; TR 6.7ms; TE 1.4ms; 4 echo-trains; TI 180ms; flip angle 20 degrees).

## Results:

FIESTA perfusion MRI showed significantly improved contrast-to-noise ratio (16.8 +/- 5.8 vs 13.0 +/- 3.5, $p<0.05$) when compared with conventional perfusion MRI using echo-planar readout. In addition, no serious subendocardial hypointensity artifact was observed on FIESTA perfusion MR images during first-pass transit of MR contrast medium through the left ventricle. At selective coronary angiography, 70% or greater diameter stenosis was detected in 50 of the 123 major coronary arteries. The overall sensitivity of stress myocardial perfusion MRI using FIESTA for detecting patients having at least one coronary artery with significant luminal narrowing was 90% (26 of 29 patients). The sensitivity and specificity of stress myocardial perfusion MRI using FIESTA in predicting significant stenosis in the individual coronary artery were 84% (42 of 50 arteries) and 90% (66 of 73 arteries), respectively.

## Conclusion:

Myocardial perfusion MRI with FIESTA demonstrated improved contrast-to-noise ratio and overall image quality when compared with conventional perfusion MRI using a hybrid echo-planar method. Excellent specificity was observed because subendocardial hypointensity artifact did not substantially deteriorate the detection of subendocardial ischemia with this approach. Stress myocardial perfusion MRI using FIESTA permits accurate detection of significant coronary artery disease in patients with suspected coronary artery disease.

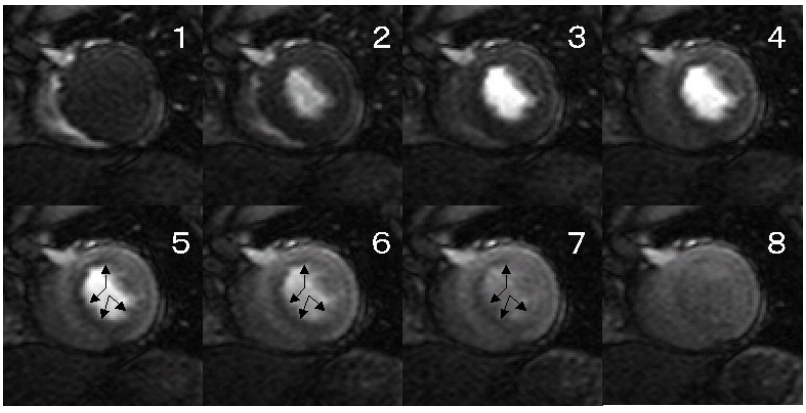


Figure:
Stress perfusion MRI using FIESTA in double vessel disease. Ischemic myocardium was clearly depicted as subendocardial perfusion defects in anteroseptal wall and inferior wall (arrows).

## References:

1. Schreiber WGJ, et al. JMRI. 2002;16:641-52
2. Fenchel M, et al. JMRI. 2004;19:555-63.