

ORAL PRESENTATION

Open Access

# Arterial spin labeled MRI detects clinically relevant increases in myocardial blood flow with vasodilatation

Zungho Zun<sup>1\*</sup>, Padmini Varadarajan<sup>2</sup>, Ramdas G Pai<sup>2</sup>, Eric C Wong<sup>3</sup>, Krishna S Nayak<sup>1</sup>

From 2011 SCMR/Euro CMR Joint Scientific Sessions  
Nice, France. 3-6 February 2011

## Objective

This study sought to demonstrate the potential for arterial spin labeling (ASL) to differentiate normal and ischemic myocardial segments based on increase in myocardial blood flow (MBF) with vasodilatation.

## Background

Myocardial ASL is a promising technique for the assessment of MBF because of the absence of contrast agents. Patients with end-stage renal disease cannot tolerate contrast agent, and therefore stand to potential benefit from myocardial ASL. MBF in healthy myocardium is known to increase by 4 times during vasodilator-induced stress, compared to at rest [1].

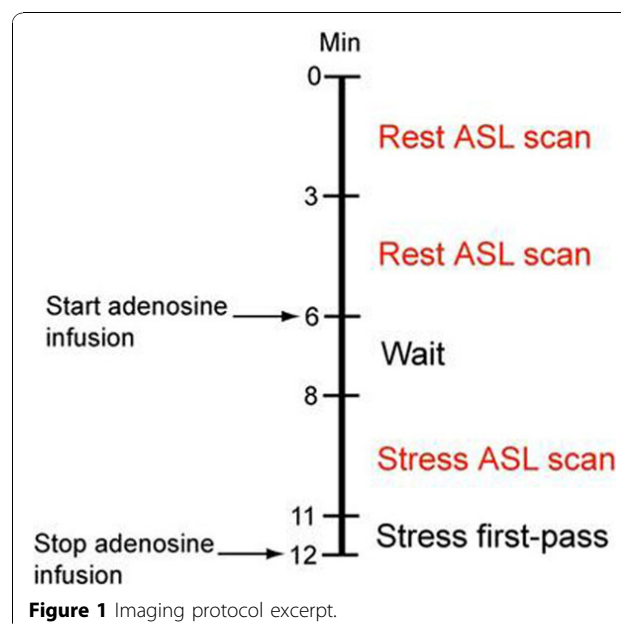
## Methods

Twenty nine patients were recruited from those scheduled for routine cardiac MR (CMR) exams. All MRI experiments were performed on a GE Signa 3T scanner. Myocardial ASL measurements were obtained from a single mid short-axis slice, using flow-sensitive alternating inversion recovery (FAIR) tagging and balanced steady-state free precession (SSFP) imaging [2]. Rest-stress myocardial ASL scans were incorporated in CMR exam including first-pass imaging during adenosine infusion of 0.14 mg/kg/min (Figure 1). Based on CMR results, patients who were suspected to have severe ischemic heart disease also underwent X-ray angiography.

## Results

Among 29 patients, fifteen patients were found to be normal based on having no visible perfusion defect on

first-pass MRI and no significant stenosis on X-ray angiogram. Ten patients had both perfusion defects and stenosis. Four remaining patients showed perfusion defects but no stenosis. Table 1 summarizes the perfusion analysis performed in both whole myocardium and myocardial segments after excluding subjects with signal-to-physiological-noise ratio < 2.0 [2]. The normal segments included all six segments [3] of the whole myocardium in normal patients and ischemic segments included the most ischemic segments in the patients with stenosis confirmed by X-ray angiography. MBF increase with adenosine in the global and segmental myocardium in normal patients were both statistically significant with  $p < 0.0001$  while MBF increase with



<sup>1</sup>University of Southern California, Los Angeles, CA, USA  
Full list of author information is available at the end of the article

**Table 1 MBF at rest and during stress (ml/g/min) and perfusion reserve**

Subject	Normal whole myocardium		Normal myocardial segments		Ischemic myocardial segments	
N	12		66		11	
Condition	Rest	Stress	Rest	Stress	Rest	Stress
MBF	1.19±0.46	3.99±1.39	1.20±0.88	3.90±1.30	1.48±0.46	2.17±1.53
Reserve	4.21±3.44		2.87±2.10		1.44±0.97	

adenosine in ischemic segments were not statistically significant with  $p=0.1032$ , based on paired t-test. Difference in perfusion reserve ( $MBF_{stress}/MBF_{rest}$ ) between normal and ischemic segments was statistically significant with  $p=0.0296$ , based on unpaired t-test.

## Conclusion

This study has demonstrated that myocardial ASL is able to capture adenosine-induced MBF increase in normal myocardium while detecting insignificant increase in ischemic myocardium. This suggests that myocardial ASL with vasodilation has a potential to diagnose angiographically significant heart disease.

## Author details

<sup>1</sup>University of Southern California, Los Angeles, CA, USA. <sup>2</sup>Loma Linda University Medical Center, Loma Linda, CA, USA. <sup>3</sup>University of California, San Diego, La Jolla, CA, USA.

Published: 2 February 2011

## References

1. Kaufmann, et al: *Am J Physiol Heart Circ Physiol* 2007.
2. Zun, et al: *MRM* 2009.
3. Cerqueira, et al: *Circulation* 2002.

doi:10.1186/1532-429X-13-S1-O94

**Cite this article as:** Zun et al.: Arterial spin labeled MRI detects clinically relevant increases in myocardial blood flow with vasodilatation. *Journal of Cardiovascular Magnetic Resonance* 2011 **13**(Suppl 1):O94.

Submit your next manuscript to BioMed Central and take full advantage of:

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at  
www.biomedcentral.com/submit

