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Meeting abstract

1111 Combined use of real-time cine and first-pass perfusion with dobutamine stress

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Introduction

Pharmacologic stress testing with cardiac magnetic resonance (CMR) may use either dobutamine to assess contractility or adenosine to assess perfusion. Certain clinical factors may preclude the use of adenosine, such as severe obstructive pulmonary disease or high-grade conduction system disease. Using current techniques for ECG-gated acquisition that require breathhold may be difficult at peak inotropic stress due to both poor ECG signal detection and patient factors. We report successful implementation of a hybrid approach to dobutamine stress CMR using real-time cine imaging with parallel acquisition and first-pass perfusion imaging at peak stress to provide both wall motion and perfusion assessment for ischemia that is feasible in a broad spectrum of cardiovascular patients.

Purpose

To evaluate the clinical utility of real-time cine in combination with perfusion imaging for dobutamine stress cardiac magnetic resonance

Methods

Stress CMR examinations in consecutive patients presenting for clinically-directed dobutamine stress were evaluated. All studies were performed on a 1.5 T scanner (Avanto, Siemens) using a 12-channel phased array coil. Real-time cine imaging was obtained in 6 standard planes (basal short-axis, mid short-axis, and apical short-axis, HLA, VLA and 3-chamber) at rest and at each stage of graded dobutamine infusion. Appropriate patients received up to 2 mg atropine to achieve target heart rate; termination of dobutamine was based on standardized endpoints for inotropic stress testing. At peak stress, 0.075 mmol/kg gadolinium contrast agent was infused for multi-plane perfusion imaging (base/mid/apical short-axis plus horizontal long-axis). Typical scan parameters are summarized in Table 1. Myocardial contractile function at rest and peak stress was graded for each of 17 segments based on endocardial movement and systolic wall thickening as akinetic, hypokinetic, normal or hyperkinetic. Stress perfusion images were visually assessed in conjunction with delayed post-gadolinium imaging obtained 10–15 minutes after a total of 0.2 mmol/kg of contrast had been administered. For the subset of patients who also underwent coronary angiography, DCMR results were compared to angiographic data using Fisher's exact test.

Table 1: Acquisition parameters.

	Real-Time	Perfusion
Sequence Type	SSFP	GRE-EPI
Echo Time (msec)	1.1	1.2
Temporal Resolution (msec)	62–69	70–90
Repetition Time	2.2	6.0
Spatial Resolution (mm)	2.0 × 2.0	2.5 × 2.5
TSENSE Acceleration Rate	3	2
Slice Thickness (mm)	8	10
Flip Angle (degrees)	65	25

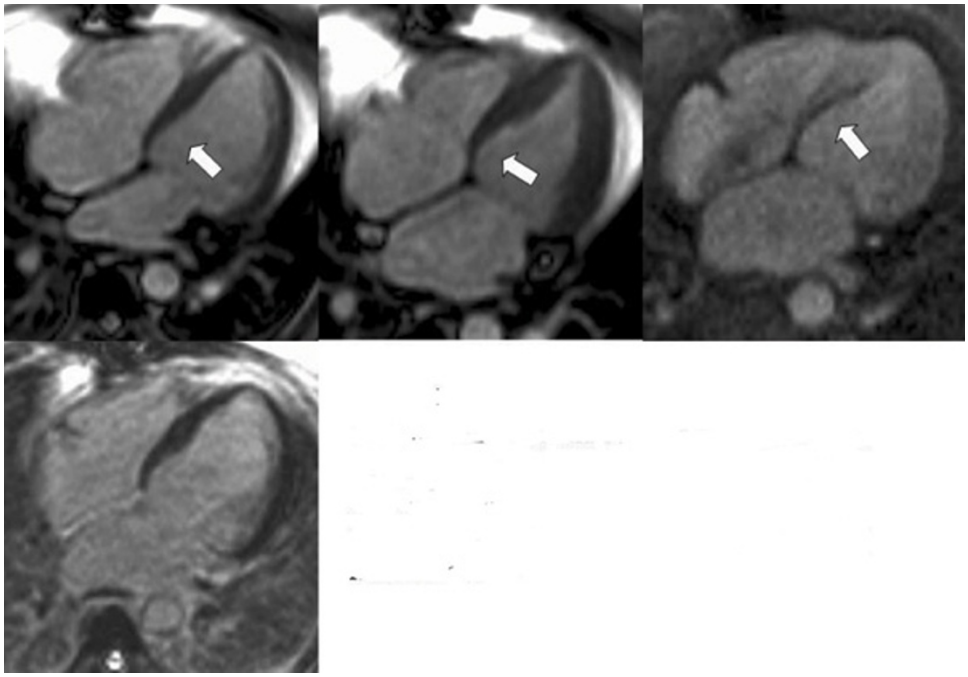

Figure 1
End diastolic and end systolic frames at peak stress with a wall motion abnormality at the base of the inferior septeum. Perfusion abnormality at peak stress. DME confirming lack of scar in the region.

Results

Between March 2005 and August 2007, fifty-five patients underwent dobutamine stress CMR with perfusion imaging (Figure 1), 31 men and 24 women. The mean age was 59 years (range 17–81 years). Clinical indications included: chest pain, cardiomyopathy, ischemia and viability (48). The remaining clinical indications were valvular heart disease (2), hemodynamic effects of coronary artery anomalies (2), syncope (2) and atrial arrhythmia with bradycardia (1). Dobutamine stress was chosen over adenosine often due to conduction system disease or bronchospastic pulmonary disease. Resting left ventricular ejection fraction averaged 45.9 ± 17.9 (range 10–68%). 80% of patients experienced no adverse symptoms with stress. Two patients experienced non-sustained ventricular tachycardia, which terminated with discontinuation of the dobutamine infusion and administration of beta-blocker. Seven had chest pain and two had dyspnea. Hypertensive response to stress (defined as blood pressure >200/105) occurred in seven patients prompting termination of dobutamine.

Image quality for rest and stress wall motion with perfusion assessment was adequate for interpretation of 17 myocardial segments in all cases. In 16 patients who also underwent cardiac catheterization, Fisher's exact test indicated good agreement (p = 0.008).

Conclusion

Clinical utility of dobutamine stress CMR coupled with perfusion imaging is a clinically feasible stress modality. Real-time cine without requiring breath-holding or ECG gating and rapid perfusion imaging allows timely completion of stress imaging with good accuracy.