MYOCARDIAL FUNCTION

Prediction of Regional Functional Recovery After Acute Myocardial Infarction with Low Dose Dobutamine Stress Cine MR Imaging and Contrast Enhanced MR Imaging

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ABSTRACT

Purpose. Previous studies demonstrated that low-dose dobutamine stress cine magnetic resonance imaging (MRI) and delayed contrast-enhanced MRI can provide assessments of myocardial viability. The purpose of this study was to evaluate the comparative diagnostic values of dobutamine cine MRI and delayed contrast-enhanced MRI for predicting functional recovery of myocardial contraction in patients with acute reperfused myocardial infarction. *Methods.* Twenty-three patients with myocardial infarction after percutaneous coronary interventions were studied. All patients underwent steady-state cine MRI covering the entire left ventricle at rest and during low-dose dobutamine stress (10 μg/kg/min). Delayed contrast-enhanced MR images were acquired to determine transmural extent of hyperenhancement. Second cine MR images in the resting state were obtained 3 to 11 months after revascularization. *Results.* On the first cine MR images in the resting state, 278 (20%) of 1380 segments demonstrated abnormal, regional contraction (systolic wall thickening <40%). Of the 175 segments showing functional recovery on the following cine MRI, 156 (89%) segments were recognized as reversible by dobutamine cine MRI and 146 (83%) segments by delayed contrast-enhanced MRI. The sensitivity, specificity, and accuracy of dobutamine stress cine MRI was 89%, 80%, and 86%, respectively. These values of contrast-enhanced MRI were 83%, 72%, and 79%, respectively. The area under the receiver operating curve (ROC) was 0.87 by dobutamine cine MRI and 0.78 by delayed contrast-enhanced MRI (p < 0.05). *Conclusions.* The current results using quantitative segmental analysis indicated that low-dose dobutamine stress cine MRI can predict recovery of myocardial

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contractility with significantly higher diagnostic performance in comparison with contrast-enhanced MRI in patients with myocardial infarction who underwent revascularization.

Key Words: Magnetic resonance imaging; Myocardial viability; Contrast media; Dobutamine stress; Myocardial infarction.

INTRODUCTION

Percutaneous coronary intervention has shown to be effective for coronary reperfusion and myocardial salvage in patients with acute myocardial infarction. Even after successful revascularization, however, non-necrotic myocardium salvaged by reperfusion may not immediately regain appreciable contractile function (Braunwald and Kloner, 1982). Noninvasive techniques for distinguishing reversible and irreversible myocardium are becoming important in managing patients with acute myocardial infarction. While positron emission tomography using [^{18}F]fluorodeoxyglucose has been recognized as a good predictor for the diagnosis of myocardial viability, this method is not widely available in clinical hospitals (Brunken et al., 1986; Di Carli et al., 1995; Tamaki et al., 1989; Tillisch et al., 1986).

Dobutamine echocardiography has been established as a reliable and safe means for both detecting hibernating myocardium (Afridi et al., 1995; Cigarroa et al., 1993; Perrone-Filardi et al., 1995) and predicting reversible myocardial dysfunction in patients after reperfused myocardial infarction (Leclercq et al., 1997; Watada et al., 1994). Compared with echocardiography, magnetic resonance imaging (MRI) can be more suitable for evaluating reversible and irreversible myocardium, because it is relatively independent of the operator's skill, and the entire left ventricle can be imaged with optimal imaging planes. MRI-assessed, dobutamine-induced, systolic wall thickening was proved to be a reliable indicator of myocardial contractile recovery in previous studies (Baer et al., 1994; 1995; 1996; 1998; Sandstede et al., 1999). However, the dobutamine stress test using fast gradient echo cine MRI has several limitations, including reduced blood contrast in patients with wall motion abnormalities and lengthy imaging time to cover the entire left ventricle on multiple imaging planes. With the recent introduction of steady-state cine MR sequences, stress cine MR images encompassing the entire left ventricle can be acquired in 5 minutes while maintaining an excellent endocardial border definition.

Assessment of transmural extent of myocardial infarction on delayed contrast-enhanced MRI is another approach that can predict recovery of regional contractile function in patients with myocardial infarction. Since no administration of dobutamine is required in the magnet, delayed contrast-enhanced MRI is well suited for assessing myocardial viability in both the acute (Choi et al., 2001) and chronic setting (Kim et al., 2000; Klein et al., 2002; Ramani et al., 1998). However, the diagnostic values of dobutamine stress cine MRI and contrast-enhanced MRI for distinguishing reversible and irreversible myocardium have not been well documented by using a quantitative segmental analysis.

The purpose of this study was to determine the comparative diagnostic performances of dobutamine cine MRI using the steady-state MR sequence and delayed enhanced MRI for predicting regional functional recovery in patients who underwent reperfusion therapy after myocardial infarction.

METHODS

Patient Population

The study protocol was approved by the Institutional Ethics Committee. All patients gave informed consent before entering the study. Twenty-three patients (20 men and 3 women; mean age of 63.1 ± 9.8 years) with first myocardial infarction who underwent percutaneous transluminal coronary angioplasty (PTCA) during the acute phase of myocardial infarction were enrolled in this study (Table 1). The diagnosis of myocardial infarction was made from clinical history, electrocardiogram (ECG), and an increase in plasma creatine kinase level of at least twice above the normal values ($>480 \, IU/L$). Patients were excluded if they had severe arrhythmias, unstable angina pectoris, claustrophobia, or standard contraindications to MRI such as pacemakers. On follow-up coronary angiography that was performed after the second cine MRI, seven of 23 patients (30.4%) demonstrated restenosis, and PTCA was performed on four patients.

Low-Dose Dobutamine Cine MRI

Low dose dobutamine cine MRI was performed within 1 month (24.8 ± 6.1 days) after onset of

Table 1. Patient characteristics.

Case no.	Age	Gender	Infarct region	Peak CPK (IU/L)	EF (%)
1	59	male	Anteroseptal	9401	41.5
2	61	male	Posterolateral	2818	57.4
3	65	male	Extensive anterior	8201	27.3
4	43	male	Inferior	3244	34.6
5	51	male	Anteroseptal	3634	59.9
6	57	male	Anteroseptal	6780	53.4
7	66	male	Posterolateral	4039	45.5
8	77	female	Anteroseptal	2900	52.4
9	76	male	Anteroseptal	2628	49.1
10	57	male	Inferior	1236	58.5
11	57	male	Posteroinferior	6050	48.0
12	71	male	Anteroseptal	593	41.7
13	62	male	Inferior	1440	61.6
14	61	male	Inferior	1324	48.0
15	51	female	Anteroseptal	1853	51.9
16	64	male	Anteroseptal	7364	34.0
17	68	male	Posterolateral	3790	56.5
18	69	male	Inferior	2408	45.3
19	78	female	Anteroseptal	904	72.0
20	71	male	Anteroseptal	965	74.1
21	72	male	Anteroseptal	1712	56.7
22	72	male	Anteroseptal	2726	41.4
23	41	male	Anteroseptal	7970	68.2

CPK = creatine phosphokinase, EF = ejection fraction.

myocardial infarction. The MR images were obtained with a 1.5 Tesla cardiac MR imager (Signa CV/i, GE Medical Systems, Milwaukee, WI). Beta-adrenergic blocking agents were withdrawn 24 hours before the MR study. Patients were positioned supine on the table and MR images were acquired by using cardiac multicoil arrays as receivers. Coronal, transaxial, and single-oblique, ventricular, long-axis, scout MR images were obtained to determine the final short-axis imaging planes. Short-axis cine MR images were obtained from mitral-valve insertion to apex to encompass the entire left ventricle by using a breath-hold cine MR sequence with a steady-state free precession (Fast Imaging Employing Steady State Acquisition, GE Medical Systems, Milwaukee, WI). The number of slices to cover the left ventricle ranged from eight to 12. The imaging parameters were as follows: repetition time of 4 ms, echo time of 1.7 ms, flip angle of 60°, matrix of 256 × 128, field of view of 320 mm, and section thickness of 10 mm. Imaging time per slice location was approximately 8 seconds. After acquiring resting-state cine MR images without removing the patient from the magnet, dobutamine was administered intravenously by using a digital perfusion

pump while recording heart rate and blood pressure at 1-min intervals. A dose of 5 μg/kg body weight per minute was infused into a peripheral vein for the first 3 minutes. After determining that patients had no severe arrhythmias or chest pain, a dose of dobutamine was increased to 10 μg/kg body weight per minute. Acquisition of MR imaging during dobutamine stress was started when an acceleration of the heart rate was seen for each dose, at least 6 minutes and no longer 12 minutes after beginning of the infusion. Immediately after acquiring stress MR images, a 12-lead electro-cardiogram (ECG) was obtained outside of MR magnet and was compared with the control ECG that was recorded before the MR study. All patients completed the entire study protocol without major adverse cardiac events.

Delayed Contrast-Enhanced MRI

Delayed contrast MR images were obtained in all patients. The Gd-DTPA (gadopentetate meglumine; 0.1 mmol/kg, Schering, Berlin, Germany) was adminis-

tered intravenously after finishing the dobutamine stress MRI. After a 15-minute delay (Mahrholdt et al., 2002; Oshinski et al., 2001), contrast-enhanced MR images were acquired on short-axis, imaging planes of the left ventricle that were identical to those used for cine MRI. All images were acquired during breath-hold by using an inversion recovery fast gradient echo sequence. Images were obtained with a repetition time of 5.3 msec, echo time of 1.3 msec, flip angle of 20°, matrix of 256 × 160, ECG-gated acquisitions repeated every heart beat, field of view of 320 mm, and section thickness of 10 mm. An inversion time was approximately 230 msec and was adjusted in each patient to minimum normal myocardial signal (Simonetti et al., 2001).

Second Cine MRI

To determine the functional recovery of regional myocardial contractile function, follow-up cine MRI in the resting state was obtained in all patients 3 to 11 months after coronary angioplasty (174.1 ± 63.2 days). Resting-state cine MR images were acquired with the same acquisition methods used in the first cine MRI. Slice locations of follow-up cine MR images were adjusted to those of the first dobutamine cine MR images by using anatomical landmarks such as right ventricle insertion sites, papillary muscle location, and relative apex-to-base location. All patients completed the second cine MR imaging.

MR Image Analysis

Cine MR images were evaluated by using an image analysis workstation (Advantage Windows 3.0, GE Medical Systems, Milwaukee, WI). End-diastolic and end-systolic images were selected by choosing the image with smallest or largest left ventricular endocardial area in the cardiac cycle. Endocardial and epicardial contours at end-diastole and end-systole were traced manually on five slice locations by using a cardiac image analysis software (MASS-Plus, Medis, Leiden, The Netherlands). Left ventricular myocardium on each slice location was divided into 12 segments by equally spaced radii of 30° emanating from the endocardial center of the left ventricle on short-axis images. Therefore, regional myocardial contractile function was evaluated in 60 myocardial segments in each patient. Diastolic and systolic wall thickness on rest and stress cine images of the first MR study and rest cine images of the second MR study were evaluated in 1380 segments in 23 patients. Segmental wall thickness was calculated as the mean value of distances between endocardial and epicardial

contours in each myocardial segment. Systolic wall thickening was calculated by using the following formula:

Systolic wall thickening (%)

$$= \frac{\text{systolic wall thickness} - \text{diastolic wall thickness}}{\text{diastolic wall thickness}} \times 100$$

On rest cine MR images, a segment was defined as abnormal when systolic wall thickening was less than 40%. This threshold value of 40% was determined as the mean systolic wall thickening (96.1 ± 6.4%) minus 2 SD that was measured in clinically non-infarcted myocardial segments in all patients. Dobutamine-induced contractile reserve was calculated as the ratio of systolic wall thickening during dobutamine stress in comparison with systolic wall thickening in the resting state. On stress studies, myocardial segment was classified as reversible when systolic wall thickening was improved by >20% with dobutamine stress.

Myocardial hyperenhancement on contrast-enhanced MR images was scored by assessing the transmural extent of contrast-enhanced tissue in comparison with the wall thickness in each segment (0 = no enhancement; 1 = 1–25% enhanced; 2 = 26–50% enhanced; 51–75% enhanced; 76–100% enhanced) without knowing the results of the dobutamine stress cine MRI. Myocardial segments with scores of 0, 1, and 2 are defined as reversible (Kim et al., 2000).

Statistical Analysis

All data were expressed as the mean ± the standard deviation, except where noted. A two-sample Student's t-test was used in the case of continuous variables, and Fisher's exact test was used in the case of discrete variables to analyze for statistical significance. The sensitivity, specificity, and diagnostic accuracy were calculated using standard formulas. Receiver operating curve (ROC) analysis was performed to evaluate the diagnostic performances of dobutamine stress cine MRI and delayed enhanced MRI for predicting myocardial viability. The ROC curves were generated with ROCKIT software (C.E. Metz, University of Chicago). The statistical significance of the difference between the areas under the ROC curves was evaluated with an univariate z-score test. A value of p < 0.05 was considered statistically significant.

Table 2. Comparison of MRI findings based on dobutamine-induced systolic wall thickening contrast-enhanced imaging with systolic wall thickening recovery in the follow-up study.

Follow-up MRI	Dobutamine MRI			Contrast-enhanced MRI		
	Reversible	Irreversible	Total	Reversible	Irreversible	Total
Recovery	156	19	175	146	29	175
No recovery	21	82	103	29	74	103
	177	101	278	175	103	278

Follow-up MRI = Rest cine MRI obtained 3 to 11 months after revascularization.

RESULTS

Dobutamine Provocation

The basal systolic blood pressure, diastolic blood pressure, and heart rate were 117 ± 15 mmHg, 70 ± 10 mmHg, and 71 ± 13 beats/min at rest, respectively, and 147 ± 28 mmHg, 74 ± 10 mmHg, and 85 ± 15 beats/min during low-dose dobutamine administration, respectively. There was no significant difference between diastolic blood pressures at rest and during dobutamine administration. Systolic blood pressure and heart rate were significantly increased during dobutamine administration ($p < 0.01$).

Diagnostic Accuracy of Dobutamine Stress MRI and Delayed Contrast Enhanced MRI

On the first rest cine MR images, regional contractile function was normal in 1102 (80%) of 1380 segments, while 278 (20%) segments showed abnormal regional contractile function (Figs. 1–4).

Table 2 summarizes the results on dobutamine cine MRI and delayed contrast-enhanced MRI in the 278 dysfunctional segments on the first rest cine MRI. Of the 175 segments showing functional recovery on the second rest cine MRI, 156 (89%) segments were recognized as reversible by dobutamine cine MRI and 146 (83%) segments by delayed contrast-enhanced MRI. Of the 103 segments that were dysfunctional on the second rest cine MRI, 82 (80%) segments were determined as irreversible by dobutamine cine MRI and 74 (72%) segments by delayed contrast-enhanced MRI. The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of dobutamine stress cine MRI was 89%, 80%, 88%, 81%, and 86%, respectively (Table 3). The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of contrast-enhanced MRI were 83%, 72%, 83%, 72%, and 79%, respectively, when 50% threshold of transmural contrast enhancement was employed. Figure 5 demonstrates ROC curves for predicting functional recovery segment by dobutamine cine MRI and delayed contrast-enhanced MRI. The area under ROC curve was 0.87 by dobutamine cine MRI and 0.78 by delayed contrast-enhanced MRI. A statistically significant difference was

Table 3. Infarct segment-based analysis of the prediction of functional recovery.

	DOB-SWT %[95% CI]	Contrast-enhanced %[95% CI]	
		Criteria of 50%	Criteria of 25%
Sensitivity	89 [84,93]	83 [77,88]	54 [46,62]
Specificity	80 [71,86]	72 [62,80]	81 [72,88]
Positive predictive value	88 [83,92]	83 [77,88]	83 [75,90]
Negative predictive value	81 [72,88]	72 [62,80]	51 [43,58]
Diagnostic accuracy	86 [81,89]	79 [74,83]	64 [58,70]

Criteria of 50% = viable if transmural contrast enhancement was < 50%. Criteria of 25% = viable if transmural contrast enhancement was < 25%. DOB = dobutamine; SWT = systolic wall thickening; CI = confidence interval.
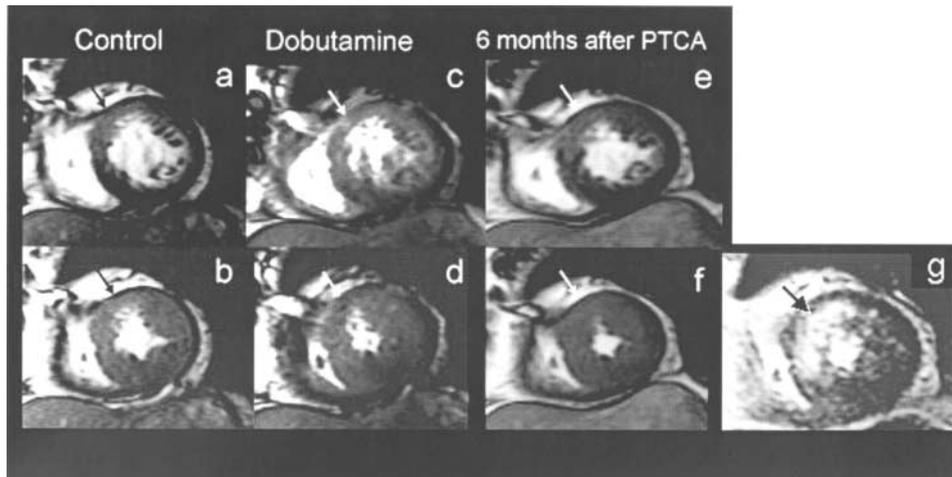
Figure 1. Cine MR images and delayed enhanced MR image in a 77-year-old female with anteroseptal myocardial infarction. Rest cine MRI (a, b), dobutamine cine MRI (c, d) and follow-up cine MRI (e, f) at end-diastole (a, c, e) and end-systole (b, d, f) were presented. Rest cine MR image (b) showed a lack of systolic wall thickening in the anteroseptal wall (arrows). During dobutamine infusion, systolic wall thickening was significantly improved, indicating the presence of reversible myocardium in the anteroseptal wall (d). On contrast-enhanced MRI, delayed enhancement involving more than 75% of the wall thickness was observed in the anteroseptal wall (g) (arrow). On rest cine MR images obtained 6 months later, significant improvement of systolic wall thickening was observed in the anteroseptal wall (f).

observed between the two methods for predicting regional functional recovery ($p < 0.05$).

DISCUSSION

The results in the current study showed that myocardial contractile reserve with low-dose dobutamine stress assessed by steady-state cine MRI can provide a sensitive and accurate means for predicting recovery of regional myocardial contraction in patients after revascularization. While contrast-enhanced MRI showed a good diagnostic accuracy (79%), the ROC analysis revealed a significantly higher diagnostic performance of dobutamine stress cine MRI in distinguishing reversible and irreversible myocardium.

Detection of Reversible Myocardium with Dobutamine Cine MRI

A pharmacologically induced contractile reserve demonstrated by high resolution imaging techniques, such as echocardiography (Afridi et al., 1995; Cigarroa et al., 1993; Leclercq et al., 1997; Perrone-Filardi et al., 1995; Watada et al., 1994) and MRI (Baer et al., 1994; 1995; 1996; 1998; Sandstede et al., 1999) has been

proved to be a reliable indicator for the presence of reversible myocardium. However, dobutamine stress echocardiography has inherent disadvantages, including the qualitative assessment and resultant variability in the interpretation of echocardiographic images and poor endocardial delineation frequently in basal lateral and inferior segments. Although MRI is less dependent on the operator's skill, and the entire left ventricle can be imaged with optimal imaging planes, the major limitation of dobutamine stress cine MRI has been a lengthy imaging time. Since cine MR images should be obtained in multiple imaging planes encompassing the entire left ventricle to achieve high accuracy, the time required to obtain a set of cine images can exceed 15 minutes with conventional cine MR sequences. With the introduction of k-space segmented, fast gradient echo sequences, cine MR images can be acquired during a single breath-hold for each slice location. However, in a recent study by Nagel et al. (1999) using breath-hold cine MRI, MR images were acquired in a relatively limited number of slice locations (three short-axis planes and two long-axis planes) during dobutamine stress. Another limitation of fast gradient echo cine MRI is decreased signal from slow blood flow due to multiple radio-frequency excitations with short repetition time, which results in poor definition of endocardial borders in patients with reduced regional wall motion.
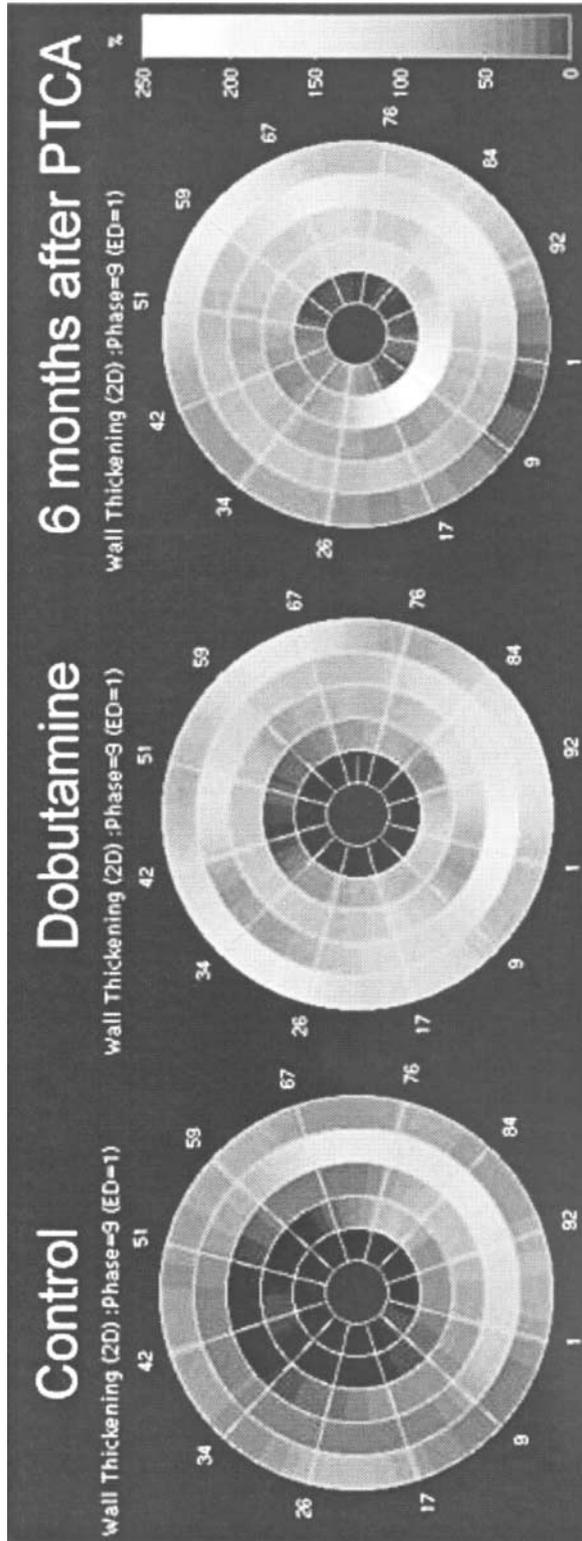
Figure 2. Bull's eye presentation of systolic wall thickening in a 77-year-old female with anteroseptal myocardial infarction. Bull's eye images demonstrate systolic wall thickening for the entire left ventricle at rest (left), during dobutamine stress (middle), and after 6 months (right) in the patient presented in Fig. 1. Decrease systolic wall thickening was observed in the anteroseptal wall (left). During dobutamine stress, regional myocardial contraction was substantially improved (middle). The second rest cine MRI after 6 months (right) shows improved regional myocardial contraction in the majority of the dysfunctional segments on the first rest cine MRI.
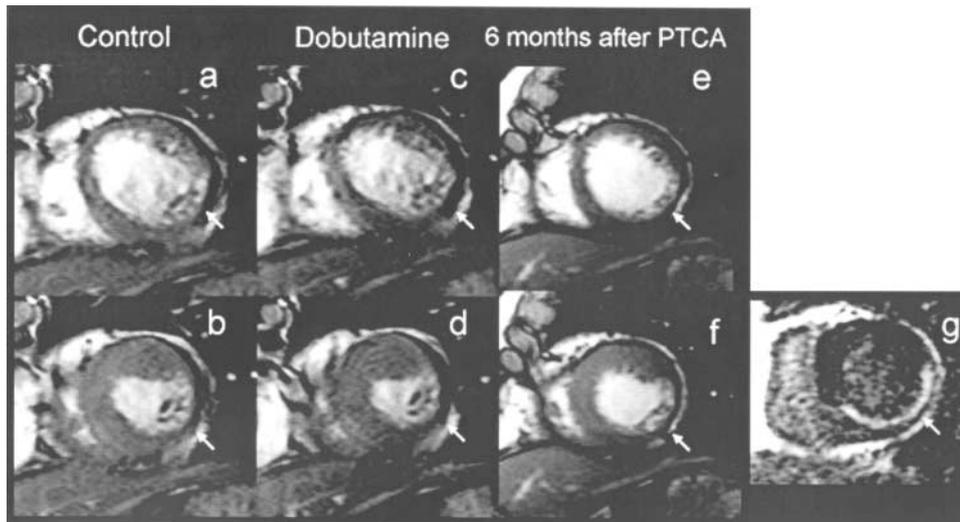
Figure 3. Cine MR images and delayed enhanced MR image in a 57-year-old male with posteroinferior myocardial infarction. Rest cine MRI (a, b), dobutamine cine MRI (c, d) and follow-up cine MRI (e, f) at end-diastole (a, c, e) and end-systole (b, d, f) were presented. Rest cine MR image (b) showed a lack of systolic wall thickening in the posteroinferior wall (arrows). During dobutamine infusion, systolic wall thickening was not improved, indicating the irreversible myocardium in the posteroinferior wall (d). On contrast enhanced MRI, delayed myocardial enhancement involving more than 50% of the wall thickness was observed in the posteroinferior wall (g) (arrow). On rest cine MR images obtained after 6 months, no recovery of systolic wall thickening was observed in the posteroinferior wall (f).

Dobutamine Stress Test with Steady-State Cine MRI

In the current study, rest and stress cine MR images were acquired with a steady-state cine MR sequence. The imaging time of cine MRI was substantially reduced to approximately 8 seconds per slice location, which permitted acquisition of cine MR images on contiguous imaging planes covering the left ventricle within an imaging time of five breath-holds. In addition, the signal intensity of the blood is strongly enhanced on steady state MR images without use of the contrast medium. Therefore, steady-state cine MRI allows more accurate measurement of left ventricular wall thickness.

In a previous study by Baer et al. (1998) using fast gradient echo cine MRI and a segmental analysis, the sensitivity and specificity of low-dose dobutamine cine MRI for predicting myocardial recovery was 82% (155/188) and 81% (177/219), respectively. In our study, dobutamine steady-state cine MRI showed a higher sensitivity (89%) and a similar specificity (80%) in comparison with Baer's results. These results indicated that low-dose dobutamine stress cine MRI with a steady-state cine MR sequence is highly accurate in distinguishing reversible and irreversible myocardium.

Detection of Reversible Myocardium with Delayed Contrast-Enhanced MRI

A previous study using animal models showed that delayed contrast-enhanced MRI is useful for the differentiation of reversible and irreversible myocardial injury regardless of wall motion abnormality at rest, the age of the infarct, or the reperfusion status (Kim et al., 1999). An important advantage of contrast-enhanced MRI over other imaging methods is that transmural extent of reversible myocardium is directly visualized. Since no exercise or pharmacological stress testing is required in the magnet, contrast-enhanced MRI is well suited for predicting functional recovery in clinical patients.

In the current study, the sensitivity, specificity, and accuracy of delayed contrast-enhanced MRI for predicting functional recovery in dysfunctional myocardial segments were 83%, 72%, and 79%, respectively. Kim et al. (2000) studied the diagnostic value of delayed contrast-enhanced MRI in differentiating reversible and irreversible myocardial dysfunction. When their results in the 462 segments with severe hypokinesis, akinesis, or dyskinesis before revascularization were analyzed, the sensitivity, specificity, and accuracy of delayed enhanced
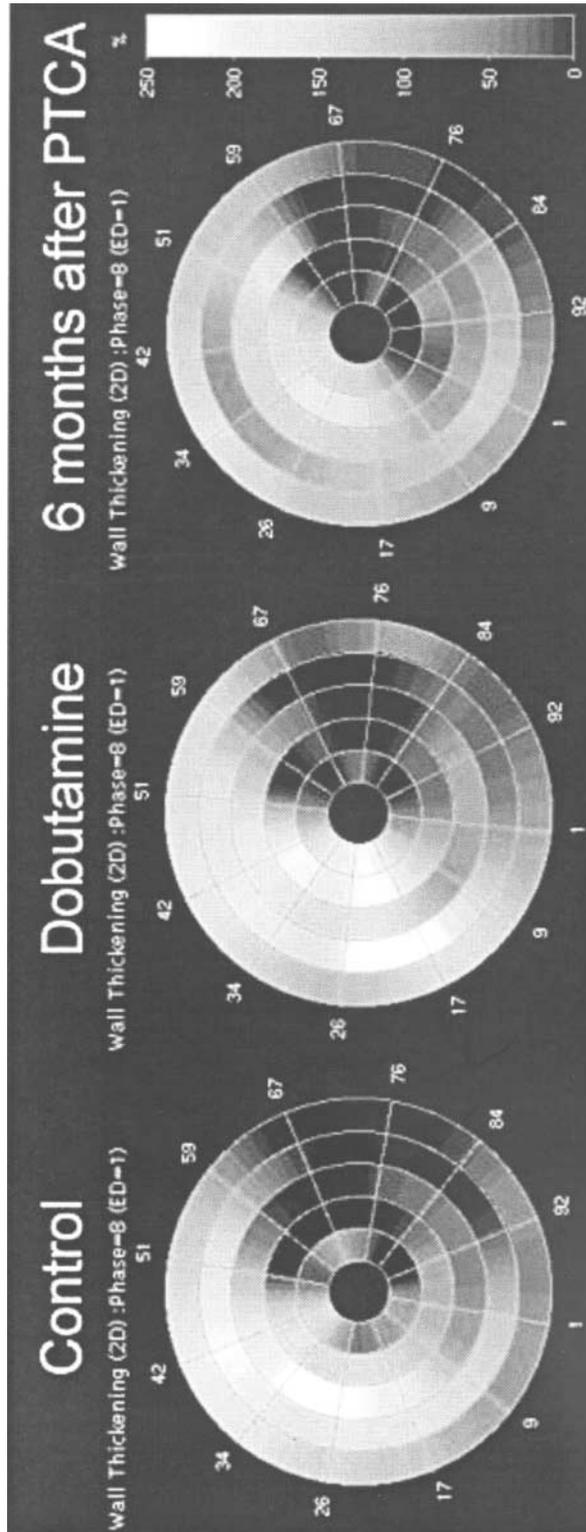
Figure 4. Bull's eye presentation of systolic wall thickening in a 57-year-old male with posteroinferior myocardial infarction. Bull's eye images demonstrate regional LV wall thickening for the entire left ventricle at rest (left), during dobutamine stress (middle), and after 6 months (right) in the patient presented in Fig. 3. The area with decreased systolic wall thickening was observed in the posteroinferior wall (left). During dobutamine stress, regional myocardial contraction was not significantly improved (middle). The second rest cine MRI after 6 months (right) shows no significant improvement of regional myocardial contraction.
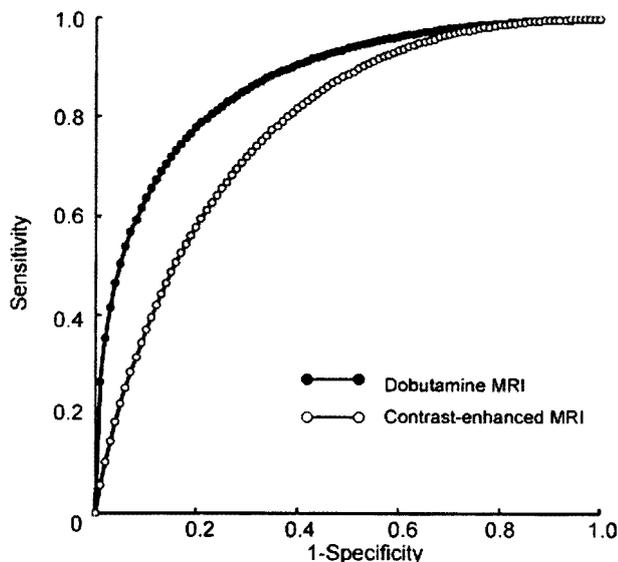
Figure 5. Receiver operating characteristics curves for dobutamine stress cine MRI and contrast-enhanced MRI in predicting recovery of regional myocardial contraction. Area under receiver operating characteristics curve was 0.87 (95% CI: 0.83–0.91) for dobutamine stress cine MRI and 0.78 (95% CI: 0.72–0.83) for contrast-enhanced MRI (p < 0.05).

MR imaging was 83%, 79%, and 81%, respectively. In another study by Choi et al. (2001), which studied the diagnostic performance of delayed contrast-enhanced MRI in patients with acute myocardial infarction, the sensitivity, specificity, and accuracy of delayed enhanced MR imaging was 75%, 73%, and 74%, respectively. The diagnostic performance of delayed contrast-enhanced MRI in the current study was similar to those reported in these previous literatures.

Clinical Implications

The data in this study indicated that both low-dose dobutamine cine MRI and contrast-enhanced MRI can be used to determine reversible and irreversible dysfunction in patients with myocardial infarction. As demonstrated by the ROC analysis, however, the diagnostic capability of dobutamine-induced, contractile reserve on cine MRI was significantly better than that of transmural extent of infarction on contrast-enhanced MRI. With use of steady-state cine MR sequences, dobutamine-induced systolic wall thickening can be assessed for the entire left ventricle within 5 minutes.

Although MR imaging time was dramatically reduced with the introduction of steady-state sequences,

the need to administer dobutamine while the patient is in the magnet remains a major disadvantage of dobutamine stress cine MRI. Therefore, transmural extent of infarction on delayed contrast-enhanced MRI plays an important role in the prediction of contractile improvement, because it does not require stress testing in the magnet and its sensitivity and specificity seem to be appropriate.

Study Limitations

There are several limitations in this study. The number of patients was relatively small, which does not permit analyses in patient subgroups with Q-wave or non-Q wave infarction. A small number of patients underwent a second MRI 3 months after infarction. While segmental analysis of systolic wall thickening for the entire left ventricle at rest and during dobutamine infusion allows precise evaluation of regional myocardial contractile reserve, manual tracing of cine MR images is time-consuming. Development and refinement of automated analysis of wall thickening on cine MRI will greatly facilitate the clinical use of dobutamine stress cine MRI. In the present study, patients in an acute state of myocardial infarction were not evaluated. All patients enrolled in this study underwent successful percutaneous transluminal coronary angioplasty during the acute phase of myocardial infarction. Further study is required to determine the comparative diagnostic values of dobutamine cine MRI and contrast-enhanced MRI in patients without revascularization in acute phase. Patency of the culprit coronary artery may influence the recovery of contractile function after myocardial infarction. A recent study demonstrated that restenosis had no impact on recovery of LV function, unless it resulted in thrombolysis in myocardial infarction (TIMI) flow grade < 3 in the infarct-related artery. While restenoses were observed in 7 patients on follow-up coronary angiography in our study, the TIMI flow grade was 3 in the infarct-related artery in these patients, indicating that influence of restenosis on LV function was relatively small (Sheiban et al., 2001).

CONCLUSION

The current results using quantitative segmental analysis reveal that low-dose dobutamine stress MRI can provide more accurate assessments for predicting regional functional recovery in comparison with delayed contrast-enhanced MRI in patients with myocardial infarction who underwent revascularization.

ACKNOWLEDGMENT

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