The combination of low dose dobutamine and delayed enhancement CMR is more predictive of infarct zone and left ventricular functional recovery than either element alone.

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Background

The spectrum of sequelae following acute myocardial infarction (AMI) is vast. For patients this can mean anything from discharge within days and continuation of their pre-morbid lifestyle, to ongoing disabling symptoms of heart failure, or death. Following AMI the affected myocardium may exhibit an array of contractile ability. Resultant regional and global left ventricular (LV) function may be normal, severely impaired or lie between these extremes. Post-AMI, local and global functionality changes over the course of the following six months in response to a multitude of variables. In this setting delayed enhancement cardiac magnetic resonance (DE CMR) has been shown to predict myocardial segmental functional recovery (FR) [1-5] but it's ability to predict global FR is less clear [5,6]. Data regarding the utility of low dose dobutamine cardiac magnetic resonance (LDD CMR) to predict both segmental and global FR following AMI are sparse and conflicting [4,5,7-9]. There are few data examining the relative and combined utility of these techniques to predict infarct zone and global LV functional recovery following AMI [5].

The degree of global LV impairment resultant from an AMI has important therapeutic implications for both drug and device therapy. In particular, recent guidelines recommend internal cardiac defibrillator (ICD) implantation forty days post-AMI in all patients developing severe LV impairment as they are at high risk of sudden arrhythmogenic death[10] Early identification of these patients may allow modulation of potential LV impairment through aggressive medical therapy and highlight cases who should be reassessed to determine if ICD implantation is required.

We hypothesised that a comprehensive CMR examination including quantitation of baseline LV dimensions, first pass perfusion kinetics, delayed enhancement, persistent microvascular obstruction and response to dobutamine would yield a model more highly predictive of both regional and global functional recovery than utilising data from the DE component alone. We examined both qualitative and quantitative variables derived from combined LDD and DE CMR, in order to delineate the most predictive model for determination of both infarct zone and global left ventricular functional recovery post-AMI, and compared the relative value of either the DE component or the LDD component alone.

Methods

55 patients presenting with AMI and a new severely hypokinetic or akinetic segment on screening echocardiogram were recruited. CMR examinations were performed on a GE 1.5T Signa CVi scanner (Waukeshau, USA) 2-6 days after presentation (baseline) and again at 6 months (follow-up)

Resting dimensions, contractile response to dobutamine, extent of delayed enhancement, extent of persistent microvascular obstruction and first pass perfusion kinetics were measured at baseline. Quantitation was performed with MEDIS 6.0.1 software (Leiden, Netherlands).

Infarct zone FR was determined by changes in quantitative wall motion, visual wall motion and average end-systolic wall thickness (ESWT) in the infarct zone.

Global FR was determined by changes in left ventricular ejection fraction (LVEF) and average ESWT over the entire LV.

Forwards linear regression was used to derive the optimal predictive models from the measured variables. Statistical analysis was performed using SPSS version 15.0.

Results

Table 1 shows the relative and combined utility of LDD and DE CMR in predicting FR within the infarct zone and globally. Regardless of the definition of infarct zone/global FR, a combined scan provides superior predictive power.

Table 1.

	LDD CMR		DE CMR		Combined	
	r	r^2	r	r^2	r	r^2
Infarct zone functional recovery						
Average quantitative WM	0.412	0.170	NM	NM	0.880	0.774
Average visual WM	0.532	0.283	0.331	0.110	0.591	0.350
Average ESWT	0.566	0.320	0.586	0.256	0.905	0.819
Global functional recovery						
Ejection fraction	NM	NM	NM	NM	0.628	0.394
Average end-systolic wall thickness	0.441	0.195	0.698	0.487	0.905	0.819

LDD=low-dose dobutamine DE=delayed enhancement CMR=cardiac magnetic resonance WM=wall motion

NM=no model (regression analysis unable to generate significant predictive model)

Conclusions

A comprehensive CMR examination with both DE and LDD allows more accurate prediction of both infarct zone and global functional recovery than either component alone. Adding LDD to a standard DE CMR requires approximately fifteen minutes and significantly improves the ability to predict infarct zone and global functional recovery.

Accurate prediction of functional recovery post-AMI with a comprehensive CMR examination may allow early identification of patients likely to require more intensive medical optimisation and post discharge monitoring of LV function. The latter would ensure implantation of internal cardiac defibrillators for primary prevention of life threatening arrhythmias in high risk patients.

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