

Accuracy of Myocardial Viability Assessment by Contrast-Enhanced MRI (Late Enhancement) Compared to Low-Dose Dobutamine Stress Echocardiography

P. Hunold¹, H. Eggebrecht², T. Schlosser¹, T. Bartel², K-U. Waltering¹, J. F. Debatin¹, J. Barkhausen¹

¹Dept. for Diagnostic and Interventional Radiology, University Hospital, Essen, Germany, ²Dept. of Cardiology, University Hospital, Essen, Germany

Introduction:

The presence of viable myocardium is a prerequisite for the recovery of regional and global function after revascularization in patients with ischemic heart disease and dysfunction of the left ventricle (LV) ¹. Different techniques have been applied to characterize viable myocardium and scar after infarction. Low-dose Dobutamine stress echocardiography has been used during the last decade ², however, positron emission tomography using [¹⁸F]-FDG as a tracer has today been considered the standard of reference in this topic ³. In recent years, contrast-enhanced MR imaging using the "late enhancement" concept has emerged to offer new opportunities in viability assessment and seems to be superior to PET ^{4,5}. Purpose of the study was to compare "late enhancement" (LE) in contrast-enhanced MRI with low-dose Dobutamine stress echocardiography (LD-DSE) in the characterization of viable myocardium in patients with CAD and impaired LV function.

Methods:

In 19 patients (male/female, 15/4; age, 62±11 yrs) with proven occlusive CAD and impaired LV function (ejection fraction, 32±13%), contrast-enhanced MRI and LD-DSE were performed prior to coronary artery bypass surgery. MRI exams (1.5T, Magnetom Sonata, Siemens Medical Systems, Erlangen, Germany) consisted of a cine study in long and contiguous short axis orientations of the entire LV using a SSFP sequence (TrueFISP; TR, 3 ms; TE, 1.5 ms; FA, 60°; slice thickness, 8 mm). 8-15 min after administration of 0.2mmol/kg BW of Gd-DTPA (Magnevist™, Schering, Berlin, Germany), the short axes were scanned with a segmented inversion-recovery TurboFLASH sequence (TR, 8 ms; TE, 4 ms; TI, 200-260 ms; slice thickness, 8 mm) to detect LE. LE was classified on a 4-point scale (score 1 = no LE, 2 = subendocardial LE of <50% of wall thickness, 3 = non-transmural LE of >50%, 4 = transmural LE). LD-DSE was performed at rest and under pharmacological stress during infusion of dobutamine (5 and 10 µg/kg/min). Regional wall motion was judged as normal, hypokinetic with recruitment under stress indicating myocardial hibernation, or hypokinetic without change under stress indicating scar. Comparison was performed using the 17-segment model according to the AHA.

Results:

A total of 323 myocardial segments were analyzed in both modalities (Table 1). 168 segments (52%) showed no LE in MRI (score 1), non-transmural scars (score 2/3) were detected in 64/47 segments (20%/15%), and 44 segments (14%) showed transmural LE. 133 segments (41%) had normal wall motion in LD-DSE, 33 (10%) hypokinetic segments improved at stress, and 157 hypokinetic segments (49%) did not change at stress and were classified as scar tissue by LD-DSE. Only 95 (61%) of these 157 segments showed any kind of LE, whereas LE occurred in 46 (35%) of the 133 segments with normal wall motion in LD-DSE (MR score 2/3/4, 29/10/7). 29 (88%) of the 33 hypokinetic segments with improved function at stress (hibernation) had MRI score 1 or 2. Of 91 segments with LE score 3 or 4, which are not expected to improve function after revascularization, LD-DSE characterized only 70 (77%) as not viable.

LE Score	1	2	3	4	
LD-DSE					
Normal	87	29	10	7	133
Hibernation	19	10	2	2	33
Scar	62	25	35	35	157
total	168	64	47	44	323

Table 1

Discussion:

In CAD patients with severely impaired LV function, low-dose Dobutamine stress echocardiography overestimates the extent of scar tissue compared to contrast enhanced MRI. On the other hand, about one third of segments without evidence of scar in MRI does not improve at low-dose stress. Those areas might contribute to the number of segments with lack of improvement after revascularization although anticipated viable. Therefore, the combination of late enhancement imaging and low-dose Dobutamine in MRI might still improve the predictive value of this promising technique to.

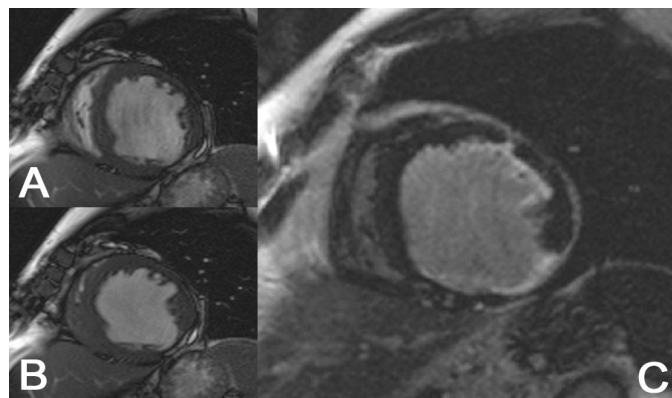


Figure 1: Patient with severe CAD and grossly impaired LV function: akinesis in the anterior and inferolateral wall, otherwise hypokinesia (A,B: Cine MRI in end-diastole and end-systole). C shows transmural LE in the inferolateral wall and non-transmural LE in the anterior, anterolateral and inferior wall. DL-DSE judged the inferoseptal, inferior and inferolateral wall as scar, the rest as hibernating overestimating.

References:

1. Pagley PR et al. *Circulation* 1997; 96:793-800.
2. Williams MJ et al. *J Am Coll Cardiol* 1996; 27:132-9.
3. Beller GA. *N Engl J Med* 2000; 343:1487-90.
4. Hunold P et al. *Rofo* 2002; 174:867- 73.
5. Kim RJ et al. *N Engl J Med* 2000; 343:1445-53.