Can left ventricular parameters examined by gated myocardial perfusion scintigraphy and strain echocardiography be prognostic factors for major adverse cardiac events?

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Assessment of left ventricular (LV) function in patients with myocardial infarction (MI) provide useful diagnostic and prognostic information [1]. Up to date, single photon emission tomography (SPET), positron emission tomography (PET), multidetector computed tomographic angiography, echocardiography (EC) and magnetic resonance imaging (MRI), have been used to examine LV parameters [2]. However, due to limitations of some imaging methods, new studies are directed to improve myocardium function evaluation.

Regional and global LV myocardial wall motion and thickening are used for the assessment and follow-up of myocardial infarction patients, who are invasively or non-invasively treated [3, 4]. Accurate semiquantitative analysis is highly reproducible and eliminates observer's variability and bias [5].

Strain (S) and strain rate (SR) EC analysis (SEC and SREC) may semi-quantitatively evaluate regional and global LV function [6]. It has been previously shown that myocardial contractility, ischemia and viability may be objectively assessed using SEC and SREC [4, 6].

By electrocardiographic gating during acquisition of myocardial perfusion scintigraphy (GSPET) we can also evaluate LV perfusion, function and ejection volumes [7]. Semi-quantitative grading of the severity of regional and global myocardial dysfunction, using GSPET, is now feasible, accurate and can be easily repeated [8, 9].

Kusunose et al. (2011) compared an automated, function imaging SEC method recently developed, in which the longitudinal systolic peak of regional LV walls was calculated and LV wall thickening was measured by GSPET [10]. These techniques showed good agreement with each other [10].

Other researchers found by GSPET, both global longitudinal systolic strain and wall motion score index (WMSI) able to identify patients with substantial MI who might benefit from urgent reperfusion treatment [11]. Recently, Lairez et al. (2013) showed that summed stress score (SSS), EC-LVEF, global longitudinal strain by EC and global wall thickening obtained by GSPET were independent predictors of mortality after MI [12].

Semi-quantitative GSPET with automatic quantitative assessment of function and perfusion seems to be one of the most promising and cost-effective methods for objective assessment of LV function, infarct size and myocardial viability [2, 13]. This technique is highly reproducible and can be used clinically for the above measurements, with the additional advantage that the ventricular performance parameters are obtained from the perfusion images. Nitrate enhanced GSPET allows both the differential diagnosis between severely hypoperfused, but still viable (hibernating) myocardium, and irreversibly fibrotic (stunning) myocardium. Furthermore, contrary to EC techniques used to assess LV volumes and function, which are time-consuming and observer-dependent, the GSPET technique is nearly totally automatic. In addition, this technique is not prohibited in patients with a pacemaker as is MRI, or in renal insufficiency as is enhanced computed tomography.

Two-dimensional EC is the most widely used imaging modality for evaluating LV function. However, S and SR as Doppler techniques, have important limitations as being angle dependent and user's dependent. [6]. Strain Doppler

EC is unsuitable in patients who have inadequate EC windows; in these patients GSPET can be applied. On the other hand, in patients with adequate EC window, strain Doppler imaging gives no radiation as compared to GSPET. Technical problems including low count scans, gating errors, arrhythmias and patients' motion during the GSPET acquisition are also possible limitations affecting the quality of perfusion of the GSPET studies [14]. On the contrary, automation of image processing and semi-quantitation have made the GSPET technique simple, friendly to users and useful in clinical practice.

In a study by the authors of this paper, in patients with MI of the left anterior descending artery, the SEC and the nitrate enhanced-GSPET, LV and wall motion and wall thickening parameters were compared by segmental analysis in predicting major adverse cardiac events (MACE) including nonfatal MI, death, malignant arrhythmias, hospital admission for heart failure or unstable angina. During follow-up of a median period of time of 24 months, the SEC and GSPET above parameters in the MACE (+) group (14 patients) were statistically higher than in the MACE (-) group (40 patients) (Table 1). The multivariate Cox regression analysis revealed that S, SR and WMSI were independent significant predictors of MACE (HR: 1.58, 2.94 and 2.89, respectively). These patients matched for age and gender and differed for hypertension, diabetes and smoking habits.

***Table 1**. Scintigraphic and echocardiographic parameters in patients with and without MACE*

Parameters	MACE (+) (n=14)	MACE (-) (n=40)	P
Gated SPET			
LVEF (%)	35±12	43±9	<0.05
LVEDV (mL)	147±21	127±29	<0.05
LVESV (mL)	92±28	65±14	<0.05
Summed rest score	25±10	18±11	<0.05
Summed motion score	34±12	26±13	0.05
Summed thickening score	28±13	21±10	0.05
Wall motion score index	1.6±0.6	1.2±0.4	<0.05
Wall thickening score index	1.7±0.5	1.3±0.6	<0.05
Strain echocardiographic			
LVEF (%)	37±10	45±8	<0.05
LVEDV (mL)	136±28	113±38	<0.05
LVESV (mL)	89±25	58±27	<0.05
LV global strain value	-9.6±3.4	-11.6±3.5	<0.05
LV global strain rate value	-0.9±0.3	-1.1±0.2	<0.05

MACE: Major adverse cardiac event, LVEDV and LVESV: Left ventricular end diastolic volume and end systolic volume, EF: Ejection fraction

In conclusion, SEC and GSPET can be applied to semi-quantitatively assess LVEF and regional wall motion abnormalities in a noninvasive manner. These techniques can provide strong diagnostic and prognostic information related to anterior myocardial infarction. In addition to this, nitrate enhanced GSPET allows to identify stunning and hibernating myocardium. New methods of reconstruction on GSPET systems will better improve image quality using lower count rates.

The authors declare that they have no conflicts of interest.

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