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Detection of Viable Myocardium in Patients with Myocardial Infarction (MI) with Dobutamine Stress Echocardiography (DSE) Comparing with Single Photon Emission Computed Tomography (SPECT-MPI)

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Abstract:

Aims and objectives: To evaluate the role of Dobutamine Stress Echocardiography (DSE) in detecting viable myocardium in patients with myocardial infarction comparing with Single Photon Emission Computed Tomography (SPECT-MPI). Methodology: It was a prospective study, conducted over sixty one patients of MI in Bangabondhu SK Mujib Medical University (BSMMU). Serial DSE, SPECT-MPI and CAG were done and compared. Result: With DSE viable myocardium was found in 71.1% of territory supplied by LAD, 58.3% of territory supplied by LCX and 65.9% of territory supplied by RCA. With SPECT-MPI viable myocardium was found in 68.2% of territory supplied by LAD, 66.7% of territory supplied by LCX and 65.1% of territory supplied by RCA. Comparing two methods there was no significant difference between DSE and SPECT-MPI in determining viable myocardium (p>0.05). Conclusion: DSE is effective in detecting viable myocardium in patients with MI, which is comparable to SPECT-MPI.

Key words: DSE, SPECT-MPI, Viable myocardium.

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Introduction:

In planning therapy following myocardial infarction assessment of viable myocardium is essential. Particularly the proportion of viable myocardium is a major factor to determine the benefit of revascularization.[1] Dobutamine echocardiography is a new promising method to distinguish viable but jeopardized myocardium from necrotic areas.[2]

The clinical role of MPI using single photon emission computed tomography (SPECT) has been established about three decades ago. MPI agents are potential myocardial flow tracers; thus they identify abnormal flow early in the ischaemic cascade, before wall motion abnormality or ECG changes become apparent.[3] Since the pioneering work of Schelbert et al,[4] 18F- fluoro-deoxyglucose (FDG) positron emission tomography (PET) has continued to be the method preferred for the assessment of viability with enhanced uptake of the glucose analog FDG in relation to the flow.[5] PET is costly and not available in Bangladesh. SPECT MPI is available in limited number of hospital in Bangladesh, whereas echocardiography is cheaper and available modality. So, we aimed to asses the diagnostic role of low dose Dobutamine stress echocardiography (DSE) in determining viable myocardium in patients following MI comparing with SPECT MPI.

Materials and Methods:

It was a prospective study to assess the myocardial viability of sixty one patients following myocardial infarction. Serial DSE and SPECT-MPI was underwent both for evaluation of myocardial viability. The study was conducted in BSMMU, Dhaka, Bangladesh, from January 2006 to December 2006.

These patients met the following criteria: the presence of a Q wave infarction, the presence of asynergy (severe hypokinesis, akinesis, or dyskinesis) on resting echocardiography, the presence of a normal sinus rhythm, and no concomitant cardiopulmonary or severe valvular diseases or evidence of left ventricular aneurysm. All patients underwent coronary angiography within three months of the two tests. The study was approved by ethical committee of BSMMU and verbal informed consent was taken before enrolling in the study.

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Results:

During the procedure of dobutamine stress echocardiography (DSE) and SPECT-MPI no clinical symptom (chest pain) or ECG change (ST depression) was experienced. Median age of total 61 subjects was 56.57 (± 10.66) years, ranging from 37 to 79 years, 79% of the patients were male and the rest 21% were female thus giving a male-female ratio of roughly 4:1. Majority (72.1%) of the patients had Q-wave MI and 4.9% had non Q-wave MI, 9.8% had post MI with angina and 13.1% demonstrated ischaemic cardiomyopathy. 30% of the patients had inferior MI, another 30% had anteroseptal MI, approximately one-quarter had anterior inferior MI, 11.5% had Anterior MI. Very few had post anterior inferior MI (1.6%) and extension anterior MI (3.3%) (Table-1).

Extent of disease detected by DSE of the 54 patients, in the territory of SVD in 29.6%, DVD in 37% and TVD in 33.3%. DSE detected viable myocardium in 71.1% of the LAD supplied territory, nearly 60% of LCX and 65.9% of RCA supplied area (Table 2). SPECT-MPI detected viable myocardium in around two-third of the area supplied by LCX and RCA and 68.2% areas supplied by LAD (Table-3). Angiographically, out 61 cases of MI, more than half (52.5%) had TVDs followed by 26.2% DVDs and 21.6% SVDs. Over 90% of the patients were angiographically detected as having significant stenoses and the rest did not have significant stenosis (Table-4). Table 5 compares the viable myocardium detected by DSE and SPECT MPI. In diagnosing viability status in the territories supplied by LAD, LCX and RCA, the accuracy of two diagnostic modalities were found to be almost comparable ($p > 0.05$).

Table-I

Demographic and Clinical Characteristics of the 61 Patients

Variables	Frequency (n=61)	Range/ Percentage
Median age (Years)	56.57 ± 10.66	37 - 79
Hypertension	52	85.2
Dyslipidemia	46	75.4
Smoking	31	50.8
DM	29	47.5
Overweight and obese	18	29.5
Q-wave MI	44	72.1
non Q-wave MI	3	4.9
post MI with angina	6	9.8
Ischaemic cardiomyopathy	8	13.1
Anterior MI	7	11.5
Inferior MI	18	29.5
Anteroseptal MI	18	29.5
Anterior inferior MI	15	24.6
Post inferior MI	1	1.6
Extension anterior MI	2	3.3

Table-II

DSE findings.

Findings	Frequency (n=61)	Percentage
Viable myocardium under dobutamine stress		
Territory supplied by LAD (n = 45)	32	71.1
Territory supplied by LCX (n = 24)	14	58.3
Territory supplied by RCA (n = 29)	27	65.9

With DSE viable myocardium was found in 71.1% of territory supplied by LAD, 58.3% of territory supplied by LCX and 65.9% of territory supplied by RCA.

Table-III

SPECT-MPI findings.

Findings	Frequency	Percentage
Viable myocardium by SPECT MPI		
Territory supplied by LAD (n = 44)	30	68.2
Territory supplied by LCX (n = 31)	20	66.7
Territory supplied by RCA (n = 43)	28	65.1

With SPECT-MPI viable myocardium was found in 68.2% of territory supplied by LAD, 66.7% of territory supplied by LCX and 65.1% of territory supplied by RCA.

Table-IV

Distribution of patients by CAG profile (n = 61)

CAG profile	Frequency	Percentage
Extent of diseaseSVD	13	21.6
DVD	16	26.2
TVD	32	52.5
CommentSignificant stenosis	56	91.8
No Significant stenosis	5	8.2

With coronary angiography 21.6% of cases was as Single vessel disease (SVD), 26.2% double vessel disease (DVD) and 52.2% triple vessel disease (TVD). Significant stenosis was found in 91.2% cases.

Table-V

Comparison between DSE and MPI detecting viable myocardium.

Territory supplied by	Viable myocardium		p-value
	DSE (%)	SPECT MPI (%)	
LAD	71.1	68.2	0.758
LCX	58.3	66.7	0.242
RCA	65.9	65.1	0.882

Comparing two methods there was no significant difference between DSE and SPECT-MPI in determining viable myocardium ($p>0.05$).

Discussion:

Now a days evaluating the presence and extent of viable but dysfunctional myocardium by different diagnostic tests have become an important component of the clinical assessment of patients with chronic CAD and LV dysfunction after myocardial infarction. It is well established that impaired LV function in such patients is not always an irreversible process related to previous myocardial infarction, because LV function may improve considerably after myocardial revascularization procedures.[6-8]

Several noninvasive imaging methods have evolved during the past decade to identify physiological markers of myocardial viability in regions with contractile dysfunction. Low-dose Dobutamine echocardiography has been used as an effective method for evaluating myocardial viability. Previous studies of low-dose Dobutamine echocardiography have predicted the recovery of regional function after revascularization with sensitivities ranging from 74% to 92% and specificities ranging from 74% to 96%.[9-13] Recent studies comparing nuclear methods with DSE and regional wall motion after revascularization confirmed the high sensitivity and high negative predictive value of PET and thallium SPECT imaging. In contrast, DSE was found to be slightly less sensitive but more specific for predicting functional improvement.[14] As PET is not available in our country, we had no standard to see the sensitivity and specificity of DSE and SPECT. In current study with DSE viable myocardium was found in 71.1% of territory supplied by LAD, 58.3% of territory supplied by LCX and 65.9% of territory supplied by RCA and with SPECT-MPI viable myocardium was found in 68.2% of territory supplied by LAD, 66.7% of territory supplied by LCX and 65.1% of territory supplied by RCA. With coronary angiography 21.6% of cases were as Single vessel disease (SVD), 26.2% double vessel disease (DVD) and 52.2% triple vessel disease (TVD). Significant stenosis was found in 91.2% cases. Comparing two methods there was no significant difference between DSE and SPECT-MPI in determining viable myocardium ($p>0.05$). So, our study established the utility of DSE in detecting viable myocardium, which is comparable to SPECT-MPI.

Conclusion:

DSE is an effective, cheaper and easily available tool in detecting viable myocardium in patients with MI and comparable to SPECT-MPI. Further study should be conducted to compare the accuracy, sensitivity and specificity of theses two methods comparing with PET (Photon emission tomography).

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