FREQUENCY OF IMPAIRED LEFT VENTRICULAR SYSTOLIC FUNCTION BY TISSUE DOPPLER IMAGING AFTER ACUTE MYOCARDIAL INFARCTION

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ABSTRACT

Objective: To find the frequency of impaired left ventricular systolic function by Tissue Doppler imaging after acute myocardial infarction.

Material and Methods: It was a hospital based, prospective descriptive study, from July 2010 to December 2010. Total of 200 patients having acute myocardial infarction (AMI) underwent detailed tissue Doppler imaging (TDI) echocardiographic examination for assessment of left ventricular systolic function (LVSF) on day 3, in echocardiographic section of Govt. Lady Reading Hospital, Peshawar.

Results: Total study sample was 200 patients having AMI. There were 61% males and the mean age was 42 ± 5 years SD. Acute anterior MI was present in 44% of patients and 41% patients had acute inferior MI. LVS function was impaired in 35% of acute anterior MI and 9% of acute inferior MI. The peak systolic velocity (Sm) at anterior mitral annulus in acute anterior MI was 0.05m/sec and 0.06m/sec at inferior mitral annulus in acute inferior MI. There was a marked reduction in peak systolic (Sm) velocity at mitral annulus, especially at the infarction sites ($p < 0.05$).

Conclusion: The peak systolic velocities, as assessed by tissue Doppler imaging, were reduced and reflective of regional and globally reduced left ventricular systolic functions in patients with acute myocardial infarction. The Left ventricular systolic function was impaired more in anterior and inferior myocardial infarction. Majority of the patients were male.

Key Words: Acute, myocardial infarction, left ventricular systolic function, tissue, doppler imaging.

INTRODUCTION

Coronary artery disease is the leading cause of mortality and morbidity globally and acute myocardial infarction is the commonest mode of presentation[1-3]. In patients with acute myocardial infarction heart failure is characterized either by systolic dysfunction alone or by both systolic and diastolic dysfunction[4,5]. Systolic dysfunction has been recognized during the early as well as during the post myocardial infarction phase with or without left ventricular (LV) diastolic dysfunction[6]. Systolic dysfunction is an important marker of outcome following myocardial infarction because it is related to progressive LV dilatation, development of heart failure and cardiac death[7,8]. Systolic and diastolic velocities of cardiac cycle can be recorded quantitatively by Tissue Doppler Imaging (TDI) and thereby providing a more accurate way of assessing left ventricular function which is more sensitive than conventional 2D echocardiography[9-12].

TDI measures velocity of the myocardium rather red blood cells, having high feasibility, reproducibility and ease of application in clinical setting. TDI has the ability to measure global as well as regional left ventricular systolic and diastolic function by placing the sample volume at the desired region of left ventricle[13-16]. The decreased systolic velocity (Sm) indicates systolic dysfunction[17,18]. The TDI parameters, i.e. systolic velocity (Sm), early diastolic velocity (Em) and late diastolic velocity (Am) are powerful predictors of cardiac mortality. The early diastolic tissue velocity (Em) at mitral annulus is a powerful predictor of cardiac mortality in patients with left ventricular systolic impairment[19,20]. The Sm velocity <0.04 ± 1.2m/sec is the best prognosticator in long term follow up and incremental to other clinical and echocardiographic variables and can identify patients at very high risk of cardiac death in the subsequent two years[21,22].

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The aim of this study was to evaluate left ventricular systolic function by Tissue Doppler Imaging after acute myocardial infarction. The rationale of the study was to assess systolic function in patients with AMI using TDI mode of echocardiography. TDI being a new modality of assessing LVS function, should be practiced more frequently to get more information for better patient management.

MATERIAL AND METHODS

This was a cross-sectional descriptive study carried out in Cardiology Department, Lady Reading Hospital, Peshawar from July 2010 to December 2010, and was approved by hospital ethical committee. A total of 200 patients were included, the inclusion criteria being acute myocardial infarction, after taking informed written consent from them. Patients with old MI, congestive cardiac failure, valvular lesions, arrhythmias, cardiomyopathy, left bundle branch block, hypertension, age>50 years, coronary artery by-pass grafting and diabetes mellitus were excluded from the study. Every patient on 3rd day of admission underwent detail TDI echocardiography for LVS function assessment with Acuson CV70 (Siemens) echo machine equipped with TDI technology.

For the assessment of LVS function, ejection fraction (EF) was calculated from apical 4- and 2-chamber views, and then pulsed wave TDI was performed on four different sites on the mitral annulus i.e. lateral, septal, anterior and inferior. For lateral and septal sites apical 4-chamber view and for anterior and inferior sites apical 2-chamber view was used. Peak systolic velocity (Sm) was measured at all four sites of the mitral annulus. EF < 45% and peak systolic velocity (Sm) <0.06m/sec were considered as impaired LVS function. SPSS 16 was used to analyze the descriptive data.

RESULTS

Total number of patients having acute MI were 200. There were 122(61%) males and 78(39%) females. Mean age was 42 ± 5 years SD. The frequency of left ventricular systolic function on TDI among all four types of myocardial infarction is given in Table 1. In case of

Table1: Frequency of left ventricular systolic function on TDI of all four MI's

	Systolic Function on TDI		Total (%)
Type of MI	Preserved (%), (EF>45%)	Impaired (%), (EF<45%)	
Anterior	18 (9)	70 (35)	88 (44)
Inferior	64 (32)	18 (9)	82 (41)
Septal	10 (5)	—	10 (5)
Lateral	20 (10)	—	20 (10)
Total	112 (56)	88 (44)	200 (100)

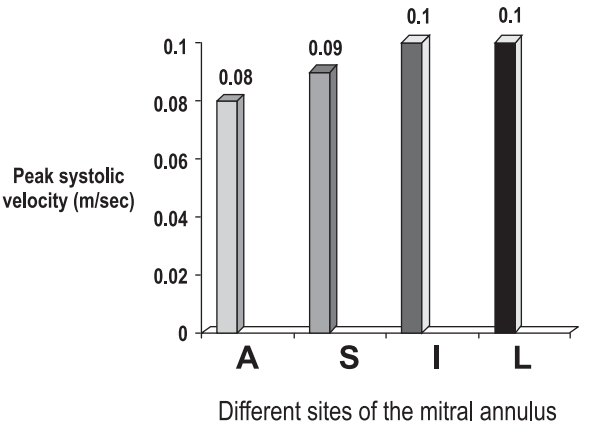

Fig. 1: Mitral annular peak systolic velocities in Anterior MI with preserved Systolic function on TDI A:anterior,S:septal,I:inferior,L:lateral

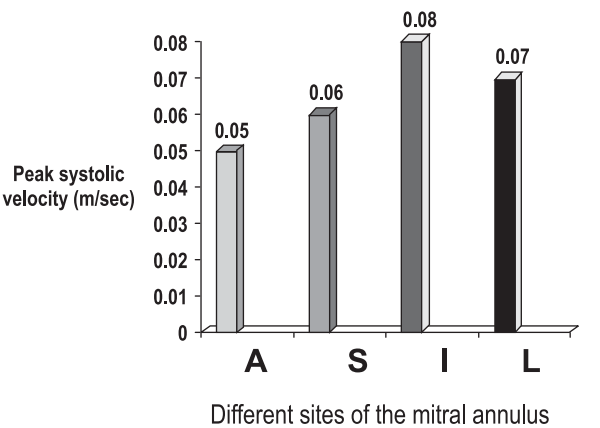

Fig. 2: Mitral annular peak systolic velocities in anterior MI with systolic dysfunction on TDI A:anterior,S:septal,I:inferior,L:lateral

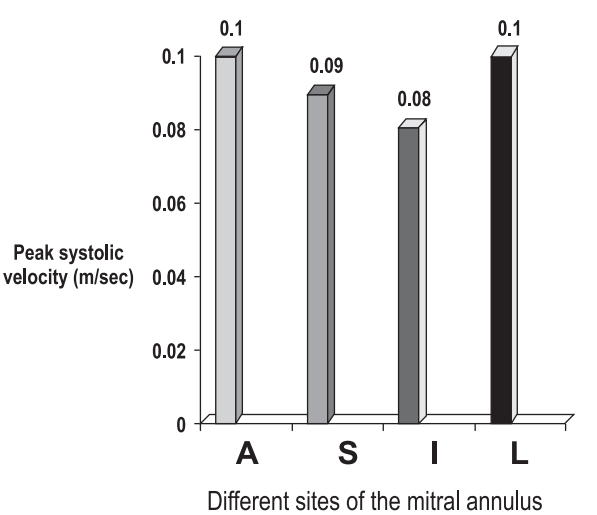

Fig. 3: Mitral annular peak systolic velocities In inferior MI with preserved syst. fun. on TDI

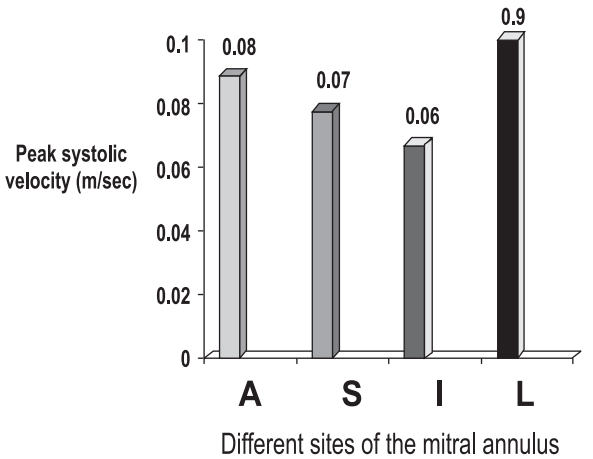

Fig. 4: Mitral annular peak systolic velocities in inf. MI with systolic dysfunction on TDI

preserved LV systolic function on TDI there was a mild reduction in mitral annular peak systolic velocity (Sm) only at the site of infarction, while in case of LV systolic dysfunction the velocity was markedly reduced at all sites with maximum reduction at the site of infarction followed by septum, $p < 0.05$ (Graph1, 2, 3, 4). Predominantly male patients (42% out of 61%) had impaired LVS function, $p < 0.05$.

DISCUSSION

Left ventricular (LV) contraction involves both a reduction of the short-axis diameter and shortening along the longitudinal axis of the chamber. The longitudinal systolic shortening of the left ventricle is reflected by the motion of the mitral annulus toward the cardiac apex in systole. The magnitude of the mitral annular motion reflects the extent of myocardial shortening along its longitudinal axis[9-14]. Analysis of mitral annulus by quantifying the myocardial velocities with the use of TDI opens up a new possibility of assessing LV function along the long axis[7,8-11]. Introduction of pulsed wave TDI at different mitral annular sites of the left ventricle opens up a new possibility[13-16].

We observed that 56% of the patients with AMI had preserved LV systolic functions but impaired in 44%, Zaca V et al[7] reported preserved LV systolic functions in 51% and impaired in 49% when they too performed TDI in their patients with first acute MI. Out of 44% patients who had systolic dysfunction, 35% had anterior MI, Esmailzadeh M et al[14] reported systolic dysfunction in 53% and out of which 44% had anterior MI. We found that mitral annular peak systolic velocity (Sm) is decreased at all four sites (anterior, septal, inferior and lateral) in patients with anterior MI ($p<0.05$) but not significantly decrease in inferior, lateral and septal MI, this same pattern has been reported by Mollema et al[8], Salehi R et al[20]. In addition to the reduced peak systolic velocity at the infarction sites, the systolic velocity at the non-infarction sites was also reduced. It is difficult to explain this phenomenon. We do not know whether the spirally oriented myocardial fiber, which causes the shortening of the left ventricle along its long axis, might have some action beyond the infarction area.

Our study documented that majority of the patients who had impaired LVS function were male ($p < 0.05$) One reason for male dominancy is, more male patients were in sample size as compared to female and the other reason may be the presence of cardiovascular diseases more in male sex in our region. Skultad H[12] et al reported no significance difference between the two sexes and different age groups.

CONCLUSION

The peak systolic velocities, as assessed by tissue doppler imaging, were reduced and reflective of regional and global reduction of left ventricular systolic functions in patients with acute myocardial infarction. The Left ventricular systolic function was impaired more in anterior and inferior myocardial infarction. Majority of the patients were male.

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