ORIGINAL ARTICLE

EVALUATION OF LEFT VENTRICULAR DIASTOLIC FUNCTION BY TISSUE DOPPLER IMAGING AFTER ACUTE MYOCARDIAL INFARCTION

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ABSTRACT

Background: Diastolic dysfunction has been recognized during the early and the post myocardial infarction phase. The aim of this study was to evaluate the left ventricular diastolic function by Tissue doppler imaging after acute myocardial infarction.

Material & Methods: It was a descriptive study, from 1st July 2010 to 31st December 2010. Total of 200 patients having acute myocardial infarction underwent detailed tissue Doppler imaging echocardiographic examination for evaluation of left ventricular diastolic function on day 3, in echocardiographic section, LRH, Peshawar. Data was analyzed Using SPSS version 16.

Results: The sample volume was divided into 4 groups i.e. anterior MI, inferior MI, septal MI, and lateral MI. There were 122 males and 78 females and the mean age was 42 ± 5.0 years. Peak early diastolic (Em) and peak late diastolic (Am) velocities were recorded at 4 different sites of the mitral annulus. Em velocity was reduced, especially at the infarction sites. The mean peak early diastolic velocity from 4 mitral annulus sites was well correlated with ejection fraction (p=0.0001). While the mean Em velocity showed negative correlation with mitral inflow early velocity (E) and also with early to late velocity ratio (E/A). The mean Em velocity was correlated well with isovolumic relaxation time. There was no correlation between mean Em velocity and deceleration time.

Conclusion: Tissue Doppler Imaging is a reliable mode of echocardiography for assessment of left ventricular diastolic functions.

Key words: Tissue Doppler imaging, Ejection fraction, Peak diastolic velocity.

INTRODUCTION

Coronary artery disease is the leading cause of mortality and morbidity and acute myocardial infarction (MI) is the commonest mode of its presentation.[1,2] In patients with acute MI heart failure is characterized either by systolic dysfunction alone or by both systolic and diastolic dysfunction. Diastolic dysfunction has been recognized during the early as well as during the post MI phase with or without left ventricular (LV) systolic dysfunction.[3,4]

Diastolic dysfunction is an important marker of outcome following MI because it is related to progressive LV dilatation, development of heart failure and cardiac death.[5,6] Systolic and diastolic velocities of cardiac cycle can be recorded quantitatively by Tissue doppler imaging (TDI) and thereby provide a newer way of assessing LV function which may be more sensitive than the traditional methods.[7,8]

TDI has a high feasibility, reproducibility and ease of application in clinical setting. It has the ability to measure global as well as regional LV diastolic function by placing the sample volume at the desired region of left ventrical.[7-10] The decreased early diastolic tissue velocity (Em) indicates diastolic dysfunction.[11-13]

The TDI parameters, i.e. early diastolic velocity (Em) and late diastolic velocity (Am) are powerful predictors of cardiac mortality.[14,15] The early diastolic tissue velocity (Em) at mitral annulus is a powerful predictor of cardiac mortality in patients with LV systolic impairment.[16] The Em velocity < 3 cm/s is the best prognosticator in long term follow up and incremental to other clinical and echocardiographic variables. An Em < 3 cm/s, Am < 4 cm/s, and E/Em > 20 can identify patients at very high risk of cardiac death in the subsequent two years.[17-19]

The aim of this study was to evaluate the left ventricular diastolic function by Tissue

doppler imaging after acute myocardial infarction.

MATERIAL AND METHODS

This was a cross-sectional descriptive study carried out in Cardiology Department, Lady Reading Hospital, Peshawar. The study duration was 6 months and was approved by the hospital ethical committee. A total of 200 patients fulfilling the inclusion critera of having acute MI were recruited, after taking written informed consent. 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.

Patients were evaluated thoroughly. Every patient on 3rd day of admission underwent detailed echocardiographic examination i.e. Conventional echocardiography and TDI with Acuson CV70 (Siemens) system. The 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 Em and peak Am were measured at all four sites of the mitral annulus. Ejection fraction was calculated by Modified Simpson's method from apical 4 and 2 chamber views. All echocardiographic measurements were analyzed without operator knowledge of the clinical data.

RESULTS

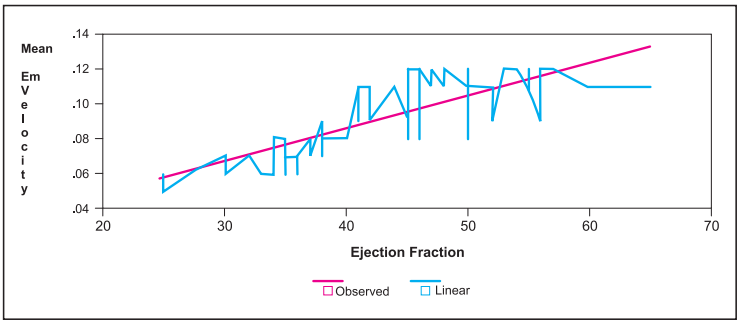
Total number of patients were 200 having acute MI and were divided into 4 groups i.e. anterior, inferior, septal and lateral MI. There were 122 males and 78 females and the mean age was 42 ±5.0 years. Anterior MI occurred in 88 (44%), inferior in 82 (41%), septal in 10 (5%), and lateral in 20 (10%) patients.

Frequency of LV diastolic dyfunction on TDI was 58%. Table 1 segregates type of diastolic dysfunction detected by TDI.

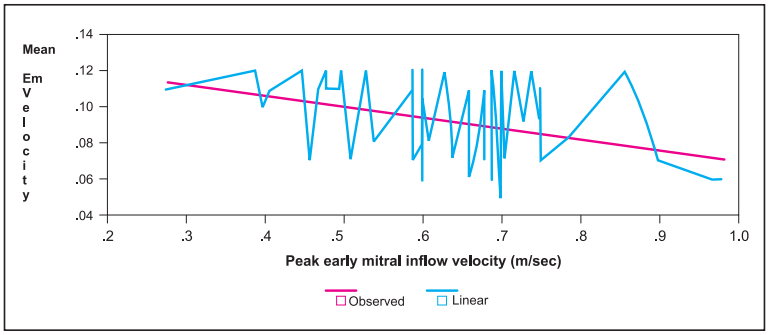
There was a marked reduction in mitral annular early diastolic velocity (Em) at all sites with maximum reduction at the site of infarction followed by septum. There was no marked change

Table 1: Frequency of various types of left ventricular diastolic dysfunction on Tissue Doppler imaging.

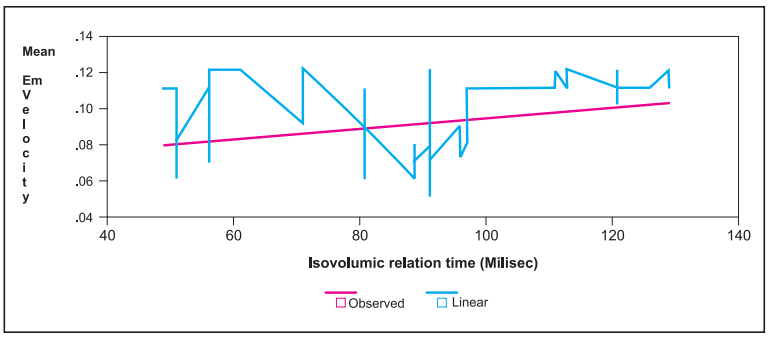
Diastolic Dysfunctiom			Total
Impaired	Pseudo normal	Restrictive	
32 (16%)	28 (14%)	56 (28%)	116 (58%)



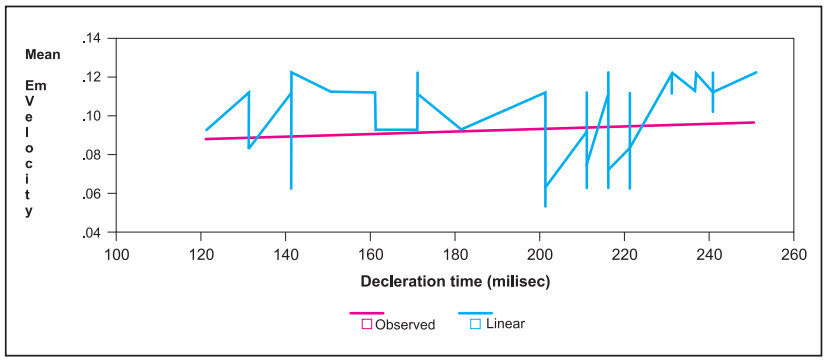
Graph 1: Correlation between mitral annular mean early diastolic velocity (Em) on TDI and ejection fraction. (p=0.0001)



Graph 2: Correlation between mitral annular mean early diastolic velocity (Em) on TDI and mitral inflow early velocity (E). (p=0.001)



Graph 3: Correlation between mitral annular mean early diastolic velocity (Em) on TDI and isovolumic relaxation time (IVRT). (p=0.004)



Graph 4: Correlation between mitral annular mean diastolic velocity (Em) on TDI and deceleration time (DT). (p=0.315)

in late diastolic mitral annular velocity (Am) at infarction site. Similarly the mean Em from 4 mitral annular sites was correlated well with the LV ejection fraction (p=0.0001). (Graph 1)

The mean early diastolic mitral annular velocity (mean Em) showed negative correlation with mitral inflow early diastolic velocity (E) (p=0.001) (Graph 2) and also with early to late velocity ratio (E/A) (p=0.011). The mean Em velocity was correlated well with isovolumic relaxation time (IVRT) (p=0.004) (Graph 3). However there was no correlation between the mean Em velocity and deceleration time (DT) (p=0.315) (Graph 4).

DISCUSSION

LV contraction involves both a reduction of the short-axis diameter and a shortening along the longitudinal axis of the chamber.[5,12] Analysis of mitral annulus by quantifying the myocardial velocities with the use of TDI opens a new possibility of assessing LV function along the long axis.[7] We were able to record LV pulse wave TDI velocities at all the LV sites in all the patients. In addition, the method is highly reproducible with low inter observer and intra observer variabilities.[7,8]

More than half, i.e. 58% of our patients were having post MI diastolic dysfunction and Salehi et al[17] reported 62%, nearly the same result. Mollema et al[15] reported 31% of patients having restrictive pattern of LV diastolic dysfunction and we recorded 28%.

The presence of diastolic filling abnormalities in post MI patients may lead to inadequate cardiac output even though the ejection fraction is normal or near-normal. Sherif et al[8] reported marked reduction in peak early diastolic velocity at all sites with a maximum reduction at the site of infarction and the findings of our study augment it.

In our study, the mean peak early diastolic mitral annular velocity (Em) correlated well with the LV ejection fraction and isovolumic relaxation time (IVRT), same observations were reported by Palmary et al[10]and Sherif et al[11]. However, there was no correlation between mean Em velocity and deceleration time (DT), The transmitral flow velocities and the IVRT are dependent on LV relaxation and on left atrial pressure,[17] so more the left atrial pressure the more will be left ventricular diastolic dysfunction. The early diastolic mitral annular velocity measured by TDI has been postulated to

be independent of the filling pressure.[11] This may be the reason for the good correlation between the early diastolic velocity determined by TDI and the LV ejection fraction.

CONCLUSION

Tissue Doppler imaging is a reliable mode of echocardiography. The peak early diastolic velocity is reduced, especially at the infarction sites and reflects regional diastolic dysfunction. While the reduced mean early diastolic velocity from 4 mitral annulus sites reflects global diastolic dysfunction and correlated well with the ejection fraction.

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