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Cardiology

MYOCARDIAL PERFORMANCE INDEX IN ACUTE ST ELEVATION MYOCARDIAL INFARCTION PATIENTS – IS THERE A ROLE?

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ABSTRACT

AIM; To assess the role of myocardial performance index in Acute STEMI patients and its value in relation to systolic, diastolic, clinical parameters and assessing prognostic value in morbidity prediction.

METHODS AND RESULTS

Study population consist of age and sex matched 60 patients and 30 controls, MPI was significantly higher in anterior infarcts than in inferior infarcts while it was 0.62±0.07 in anterior and 0.66±0.18 in anteroseptalMI as against 0.58±0.11 in inferior and 0.52±0.10 in inferior /lateral or posterior or RVMI respectively.MPI was significantly (P= 0.007) higher when the killip class of the patients increased, MPI has got inverse relationship with EF and direct relationship with Pts who developed complication .

CONCLUSION

We found from our study that MPI was found to be higher in Myocardial infarction patients especially in Anterior Infarcts, and MPI also has got good correlation with Killipclass , Systolic function parameters like LV dimension, volume, ejection fraction and fractional shortening as well as Diastolic function parameters like Deceleration time, IVRT,E/E' ratio. MPI was also found to be higher in patients who developed complication such as Heart failure and post infarction angina than in patients who did not have any complication. Hence MPI can be used for assessing LV function as well as for predicting in hospital out come in acute ST elevation myocardial infarction patients

INTRODUCTION

Echocardiography is the most readily available and commonly used non invasive diagnostic tool in cardiology, especially for the assessment of LV function. Cardio vascular disease is the most common cause of death after communicable diseases in India. Coronary heart diseases accounts for more than 50% of cardiovascular disease deaths. STEMI occurrence is a fatal event in approximately 20 to 30% of patients. Nearly one third of death occurs within one hour are mainly due to ventricular arrhythmias. But the late mortality is mainly depended on LV function. Hence LV function assessment is an integral part of any patient with acute STEMI. LV function derangement can affect systolic function, diastolic function or both. Two – dimensional echocardiography is well suited for studies of systolic function, and Doppler echocardiography provides a noninvasive technique for the assessment of diastolic function. However these measurements are load-dependent and change with the location of the sample volume, rhythm, heart rate and quality of the image. Even though systolic and diastolic dysfunction often coexists, only a few Doppler echocardiography variables combine measurements of systolic and diastolic performance. An echocardiographic index combining the measurements of diastolic and systolic performance was defined by Tei Chuwa et al5 in 1995. In its short life span, it has been shown to demonstrate powerful prognostic value in significant heart diseases such as dilated cardiomyopathy, idiopathic pulmonary hypertension, cardiac amyloidosis and recently in myocardial infarction. TEI index has also got various other advantages compared to classical 2D and Doppler parameters such as not being influenced by changes in blood pressure, heart rate, sex and age and not appearing to be affected significantly by loading condition.

AIMS

- To assess the role of myocardial performance index in Acute STEMI patients.
- To evaluate the relationship between myocardial performance index and area of infarct.
- To assess the relationship between myocardial performance index and systolic, diastolic dysfunction in Acute STEMI patients.
- To evaluate the relationship of Myocardial performance index with clinical parameters
- .To assess the Prognostic value of Myocardial performance index in in hospital morbidity.

MATERIALS AND METHODS

This study was conducted in 60 patients who were admitted to CCU, Department of Cardiology, Stanley medical college with acute myocardial infarction (STEMI). 30 age matched & sex matched control were taken for comparison.

SELECTION CRITERIA

Patients who were admitted to CCU, with first episode of acute myocardial infarction were included. The diagnosis of myocardial infarction was based on presence of any 2 of the following 3 criteria,

1. Typical precordial pain
2. ECG changes suggestive of MI (ST segment elevation of >0.1 mv in limb leads or > 0.2 mv in precordial leads)
3. Elevated cardiac enzymes. The diagnosis of I episode of MI was determined if the previous ECG was normal or there was no history or symptoms suggestive of coronary disease.

EXCLUSION CRITERIA

The following groups of patients were excluded from the study.
Patients with
1. Significant Valvular heart disease
2. Pericardial disease
3. Cardiomyopathies
4. Unstable angina
5. Significant tachy or bradyarrythmias.
6. On pace maker therapy

The entire set of patients who were included in the study were evaluated on the basis of proforma, detailed history with special focus on chest pain duration and risk factors were obtained. Patients were evaluated with a thorough echo cardio graphic analysis with in 48 hrs of admission. Their treatment history and in hospital complications were noted.

TWO –dimensional and M-mode measurements were obtained with patients in left lateral position using an ALOKA SSD4000 phased array system equipped with tissue Doppler and harmonic imaging technology. Para sternal long and a short axis as well as apical four- and two chamber views were used for the evaluation of the functions of the left ventricle and the heart valves. LV dimension and fractional shortening (FS) of the left ventricle were calculated by using teicholtz formula. Ejection fraction was obtained by modified Simpson's method. Pulse-wave Doppler measurements of mitral inflow were obtained with the transducer on the four chamber view with a 1-2 mm Doppler sample volume was placed between the tips of the mitral leaflets during diastole. The left ventricular outflow velocity curve was recorded from the apical long axis view/apical five chamber view with the sample volume positioned just below the aortic valve. Doppler velocities and time intervals were measured from mitral inflow and left ventricular outflow recordings. Isovolumetric relaxation time (IVRT) was the time interval from cessation of left ventricular outflow to onset of mitral inflow, ejection time (ET or MPI Measurement B) was the time interval from the onset and cessation of left ventricular outflow, and mitral early diastolic (E) flow deceleration time (DT) was the time interval between the peak E velocity and the end of the early diastolic flow. Total systolic time interval was measured from the cessation of one mitral flow to the beginning of the following mitral inflow (MPI Measurement A). Isovolumetric contracting time (ICT) was calculated by subtracting ET and IVRT from the total systolic time interval. MPI was calculated by using the formula MPI= MPI A- MPI B/MPI B or (IVRT+ICT)/ET. Tissue Doppler echo was performed by activating the tissue Doppler function in the same machine. Images were obtained in the apical four chamber view with the filter setting were kept low and gains were adjusted at the minimal optimal level to minimize noise. 1.7 mm sample volumes were placed at both septal and lateral mitral annular site and systolic velocity (Sm), early and late diastolic velocities (Em or E', Am or A') were obtained and average values were taken . E/E' ratio was calculated

STATISTICAL ANALYSIS

Datas are expressed as mean value ± standard deviation (SD). Comparisons between parameters of the groups were performed by using an unpaired Student's t-test. Statistical significance was defined as P ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

DISCUSSION

We studied 60 patients and 30 controls. They were studied on the basis of detailed history with focus on risk factors and chest pain duration, detailed Echocardiographic analysis was done in all the patients and controls, in hospital complications such as heart failure and post infarct angina were noted.

CLINICAL AND ECHO PARAMETERS IN PATIENTS VERSUS CONTROLS:

Among the 60 patients, 43 were male patients and 17 were female patients. Out of 30 controls 20 were males and 10 were females. When comparing patients with controls, the mean age of patient population was 50±12years while that of controls was 49±13 years. While the mean age of male patients were 48± 11 as against 56±12 in female patients, males in our study were younger than female patients, which are in consistent with the general pattern of coronary artery disease. Mean systolic BP was 128±24 in patients as against 116±8 in controls. While Diastolic Blood pressure in patients was 86±14 as against 77±5 in controls, although systolic and Diastolic BP was slightly higher in patients than in controls statistically it was not significant. We found that LV dimension and volumes in diastole and systole were significantly increased in patients, when compared to controls, while LVDd was 4.9 ±0.5 as against 4.5 ±0.4 in controls, while that of LVDs was 3.5 ±0.6 as against 3 ±0.3 in controls. Similarly EDV was 109.9 ±27.3 in patients as against 94.8 ±15.0 in controls. ESV was 54.67±20.5 as against 35.1±7.1 in controls. Ejection Fraction in patients was significantly lower than in controls, while it was 50.9 ± 8.3 in patients as against 62.2 ± 3.9 in controls. Similarly, Fractional shortening(FS) was also significantly lower in infarction patients when compared with controls, while it was 28.1±6 versus 33.7±4.6 in patients and controls respectively. Significant reductions in both parameters were in consistent with the depressed systolic function occurring in MI patients. Ejection time was found to be significantly reduced in patients than in controls while it was 238.0±24.9 in patients as against 268.7±24.9 in controls again reflecting depressed systolic function. There was not much significant difference in E, A, E/A ratio in Myocardial infarction patients when compared with controls. Deceleration time was found to be significantly lower in patients with MI than in controls. While DT was 162 ±3.6 in patients when compared to controls with 188.1±29.4.This reductions in DT reflects elevated filling pressure found in MI patients' secondary to diastolic function abnormalities. IVRT and ICT were found to be significantly elevated in MI patients than in controls. While IVRT was 92.17±17.1 as against 81.2±15.3 and ICT was 48.8±22.2 and 24.3±10 in patients and controls respectively. Similarly E/E'ratio, another Echo parameter which has got correlation with filling pressure found to be elevated significantly in MI patients than in controls. While it was 10±3.7 in MI patients as against 7.8±1.9 in controls. While MPI, an index of combined systolic and diastolic functions was found to be elevated significantly in MI patients than in controls, while it was 0.60+/-0.13 in patients as against 0.39±0.68 in controls.

INFARCT AREA AND PARAMETERS

When we analyzed clinical and echo parameters by area of the infarct, we found that pulse rate was significantly lower in inferior infarct when compared to anterior infarcts, while it was 66±9,78±12 in inferior and inferior/posterior or lateral or RVMI, as against 91±15, 92±16 in anterior wall and anterior septal MI respectively. This is in consistent with the established finding of increased vagal tone with bradycardia seen in inferior infarcts. while analyzing Blood pressure we found that there was not much difference between the infarct area and BP statistically. We have also found that there was not much statistical difference in thrombolysis treatment among different infarct areas. Out of 60 patients, 45 patients (75%) were thrombolysed in our study, while 15 patients were not thrombolysed mainly because of late presentation. When analyzing chest pain duration prior to admission we found that inferior wall MI patients were admitted late when compared to other infarcts. When analyzing the killip class of patients we found that patients with anterior infarcts had higher killip class than inferior infarcts, while the mean killip class is 1.44±0.62 and 1.58±0.77 in anterior wall and antero septal MI respectively. It was 1 &1.10±0.3 in inferior &inferior / lateral or posterior or RVMI respectively. When analyzing the LV dimension and volume there was not much difference between infarcts in different areas. End systolic volume was found to be significantly higher in anterior infarcts than in inferior infarcts. But it did not attain statistical significance Ejection Fraction was found to be significantly lower in anterior infarcts than in inferior infarcts while it was 48.9±8.8 & 48.34±7.8 in anterior and anteroseptal MI respectively, when compared to 53.13±8.03 &55.3±6.87 in inferior and inferior /lateral or posterior or RVMI respectively. On analysis of E, A, E/A, IVRT, E/E' ratio there was not much difference among the different areas of infarct. But Deceleration time (DT) was found to be decreased in anterior infarcts than in inferior infarcts, while DT was 149.9±30.8 &155.9±33.3 in anterior and anteroseptal MI respectively. It was 164.3 ± 21&180.82 ± 42.3 in inferior infarct and inferior/lateral or posterior or RVMI, respectively although the difference was statistically not significant. 56 When analyzing isovolumetric contraction time it was found to be significantly elevated in AnteroseptalMI when compared to other areas of infarcts. On analysis of myocardial performance index (MPI) we found that MPI was significantly higher in anterior infarcts than in inferior infarcts while it was 0.62±0.07 in anterior and 0.66±0.18 in anteroseptalMI as against 0.58±0.11 in inferior and 0.52±0.10 in inferior /lateral or posterior or RVMI respectively.

To summarize we found that there was significant reduction in Ejection Fraction, elevation of MPI, higher killip class, higherICT in anterior infarcts when compared to inferior infarcts, and the pulse rate was significantly lower in inferior infarcts than in anterior infarcts. These finding indicates that impairment of the systolic function is much more in anterior infarcts than in inferior infarcts.

MYOCARDIAL PERFORMANCE INDEX AND CLINICAL, ECHO PARAMETER IN MI PATIENTS

When we analyzed MPI in relation to parameters like age, sex, chest pain duration, and Thrombolytic status we found that there was not much difference statistically.

MPI AND KILLIP CLASS

Among the 60patients 43 (71.7%) were in Killip class I, 13(21.7%) belongs to Killip class II, and 4 (6.6%) belongs to Killip class III.When we analyzed the killip class of the patients and its relation to MPI we found that MPI was significantly (P= 0.007) higher when the killip class of the patients increased, while it was 0.56±0.10 in class I, 0.61±0.17 in class II, 0.71±0.2 in class III.Our findings were similar to those observed by Karvonish ht et al,5in their study they found that MPI was higher in killip class II & III, compared to Killip class I(MPI of 0.68 in Killip class II & III as against 0.34 in killip class I). It is a well established fact that killip class correlates with possible MI outcomes, since MPI reflects the killip class it 57 can also be used for assessing post MI out come. Higher MPI is associated with poor outcomes.

MYOCARDIAL PERFORMANCE INDEX AND SYSTOLIC FUNCTION PARAMETERS:

LV DIMENSION AND VOLUME

We found in our study that there was statistically significant correlation between MPI and LV dimension, volumes. With an increase in LV dimension & volumes there was increase in MPI. Our findings were similar to that of Lavine et al 9 finding, in their study they found that MPI was significantly higher in patients, who developed heart failure, with increased LV dimension & decreased Ejection fraction.

EJECTION FRACTION

When we analyzed the relationship of Ejection fraction with myocardial performance indices we found that with decreasing level of EF, there was an increase in MPI, while it was 0.50±0.07 in patients with EF >55,0.56±0.10 in patients with EF of 46-55,0.65±0.16 in patients with EF of 36-45, and it was 0.77±0.17 in patients with EF2, 58

Although MPI was high when there was abnormality associated with E/A ratio but it does not attained statistical significance. When we analyzed Deceleration time with myocardial performance index, MPI was significantly (P= 0.001) increased when there was abnormality in Deceleration time. MPI was 0.59±0.18 when DT was lesser than 150, when compared to 0.51±0.10 when DT was between 150-230.Our findings were similar to Poulsen et al's 4,8finding, they also found in their study that MPI was significantly higher in patient's with Deceleration time of < 140 msec. They had concluded in their study that decreased Deceleration time and elevated MPI were independent predictors of outcome. When we analyzed isovolumetric relaxation time with MPI, we found there was significant (P= 0.012) increase in MPI when IVRT was prolonged while MPI was 0.56±0.11 when IVRT was between 61-109, while it was 0.65±0.2 when IVRT was >110 hence MPI correlates significantly with prolonged IVRT. On analyzing E/E' ratio with myocardial performance index, we found that the MPI was significantly (P=0.003) associated with elevated E/E' ratio. When the E/E' ratio was more than 12, MPI was found to be 0.62±0.11 as against 0.58± 0.08when E/E' ratio was less than 8.

MYOCARDIAL PERFORMANCE INDEX AND COMPLICATION IN PATIENTS

On analyzing the relationship of patients with complications such as heart failure, post infarction angina, we found that patients with complication following myocardial infarction had significantly elevated MPI, when compared with patients who did not have any complication. MPI was 0.55± 0.1 in patients without any complication, while it was 0.72 ± 0.3 in patients with heart failure, 0.70 ± 0.1 in patients with post infarction angina and MPI was 0.68 ± 0.08 in patients with combination of heart failure and post infarction angina. Hence we found from our study that MPI has got good correlation with complication 59 following myocardial infarction, so it can be used for prognosis following myocardial infarction

MYOCARDIAL PERFORMANCE INDEX AND RISK FACTORS

In our study out of 43 males 34 were smokers, While 6 patients had diabetes, 4 had Hypertension, 11 had combination of risk factors such as HT and DM, DM and smoking, HT and smoking or HT, DM, Smoking. When analyzing the relationship of risk factors such as Hypertension, Diabetes, smoking with MPI, We found that the level of MPI was found to be higher in patients with risk factors than in patients without any risk factors While MPI was found to be 0.63± 0.3 in patients with Hyper tension, while MPI was 0.55 ±0.1 in patients diabetes, it was 0.61 ± 0.13 in patients with smoking and MPI was 0.59 ± 0.1 in patients with combination of risk factors, When compared to patients without risk factors in whom it was only 0.51 ±0.1.

To conclude, We found from our study that MPI was found to be higher in Myocardial infarction patients especially in Anterior Infarcts, and MPI also has got good correlation with Killip class , Systolic function parameters like LV dimension, volume, ejection fraction and fractional shortening as well as Diastolic function parameters like Deceleration time, IVRT,E/E' ratio. MPI was also found to be higher in patients who developed complication such as Heart failure and post infarction angina than in patients who did not have any complication. Hence MPI can be used for assessing LV function as well as for predicting in hospital out come in acute ST elevation myocardial infarction patients.

CONCLUSION

The following conclusions were derived from our study

- Myocardial performance index was found to be significantly elevated in myocardial infarction patients than in controls.
- Myocardial performance index elevation was found to be significantly more in anterior infarcts than in Inferior infarct patients
- Myocardial performance index has got a good correlation with systolic as well as diastolic function parameters. While Myocardial performance index was found to have a significant inverse relationship with Ejection fraction, it was also found to have significant relationship with abnormalities in diastolic function parameters like Deceleration time, Isovolumic relaxation time and E/E' ratio.
- Myocardial performance index has got a significant positive correlation with Killip class and Risk factors such as Hypertension, diabetes and smoking.
- Myocardial performance index was found to be significantly elevated in patients who developed in hospital complications like Heart failure, Post infarction angina than in patients who did not have any complications. Hence myocardial performance index can be used as a prognostic indicator for predicting out comes.

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