Original Article

Echocardiographic Evaluation of left Ventricular Function Following Late Percutaneous Coronary Intervention after Acute Anterior Myocardial Infarction with Left Ventricular Systolic Dysfunction

Md. Tufazzal Hossen[1], Sayed Ali Ahsan[2], Md. Abu Salim[3], Khurshed Ahmed[3], Md. Mukhlesur Rahman[3], Dipal K Adhikary[3], Ariful Islam Joarder[4], Md. Fakhrul Islam Khaled[4], Madhusudan Paul[1], Abu Bakar Md. Jamil[1] Md. Zainal Abedin[5], Md. Fazlul Karim[6]

Abstract:

Background: The effect of late percutaneous coronary intervention on left ventricular function is incompletely understood. Objectives: To evaluate the effect of late Percutaneous Coronary Intervention on LV systolic function following coronary stenting after acute anterior myocardial infarction. Methods: A total of 60 patients, > 24 hours to 6 weeks after anterior AMI who attended in UCC, BSMMU between July 2014 to June 2015 were included in this study. They underwent coronary stenting. After coronary stenting all patients were in TIMI flow-3. Serial echocardiographic assessment of LV function before and after late intervention with modified Simpson's rule in apical 4 chamber view as well as comparison between baseline result with that of after intervention were done. The patients were on standard medical therapy in post intervention period. Result: Mean age was 54.3±8.91 years with minimum 30 years and maximum 75 years. Most of the patients were male (67%). LVESV was 60.0±14.4 ml before PCI and 58.3±15.3 ml at discharge (p value 0.091) & 44.1±17.6 ml after 3 months (p value <0.001). LVEF was 40.2±3.1% before PCI, 40.2±3.3% at discharge (p value 0.509) & 47.6±5.9% after 3 months (p value <0.001). There was no significant improvement of LV function from baseline till discharge but significant improvement occurred after 3months. Conclusion: Using echocardiographic techniques, our results showed that left ventricular volume decreased and the left ventricular ejection fraction increased significantly after three months of late intervention.

Key Words: Late Percutaneous Coronary Intervention (PCI), LVESV (left ventricular end systolic volume), LVEF (left ventricular ejection fraction)

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Introduction:

Percutaneous coronary intervention (PCI) and stent placement has revolutionized the management of ischemic heart disease in terms of symptomatic improvement. However, it remains a question whether PCI and stenting do improve the left ventricular function and if it does, whether the improvement is to the same degree in all groups of

1. Resident (Phase-B), Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh
2. Professor, Bangabandhu Sheikh Mujib Medical University, Dhaka ,Bangladesh
3. Associate Professor, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh
4. Assistant Professor, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh
5. MD Final Part Student: Bangabandhu Sheikh Mujib Medical University, Dhaka , Bangladesh.
6. Assistant Professor, Sheikh Hasina Medical College, Jamalpur, Bangladesh.

Address of Correspondence: Md. Tufazzal Hossen, Resident Phase-B, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. Mobile No. +8801915055310, E-mail: tulaluddin70@gmail.com

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patients like those with primary coronary intervention, late coronary intervention, the patients with chronic coronary occlusion, the patients with total occluded artery and additionally what role is played by the interval between PCI and myocardial infarction and also the progression of change of left ventricular function with time following PCI.

Myocardial revascularization using PCI is widely used and improves clinical outcome particularly in post infarction patients with markedly reduced LVEF.[1] Momtahen et al.[2] suggest that PCI is associated with a significant improvement in global and regional left ventricular(LV) function and favorable clinical outcome as shown by functional improvement in NYHA class and angina severity. This improvement of LV contractility was significant 3 months post-PCI whereas it did not show further significant improvement thereafter. The LVEF improvement was nonetheless more pronounced in patients with baseline LVEF ≤40%.

Although the short term and long term beneficial effects of primary PCI are established but the benefit of late PCI is not out of controversy. Late percutaneous coronary intervention (PCI) after Acute Myocardial Infarction (AMI) is increasingly used as treatment strategy. It is a necessity to provide a research based information regarding the opportunity of improvement of left ventricular function following late percutaneous coronary intervention

This study evaluated the effect of late percutaneous coronary intervention on left ventricular systolic function by echocardiography after anterior AMI.

Methods:

This prospective observational study was done in University Cardiac Centre (UCC), Bangabandhu Sheikh Mujib Medical University (BSMMU) from July 2014 to June 2015. Sample size was calculated using the formula for determining sample size to show difference between two means. It was 60. Patients presenting between 24 hours to six weeks of acute anterior STEMI (ST-elevation myocardial infarction) in UCC from July 2014 to June 2015 were considered for the study. Among them, patients having ischemic symptoms or positive evidence of inducible ischemia in ETT, significant lesion at LAD (left anterior descending artery) and left ventricular (LV) mild to moderate systolic dysfunction were enrolled. Patients who underwent primary PCI, presented more than 6 weeks after acute myocardial infarction, with valvular heart disease, with unsuccessful PCI, having severe LV systolic dysfunction (EF <30%) or normal LV systolic function and coronary involvement other than LAD were excluded from the study.

Patients' demographic profiles were recorded. All patients underwent 2-dimensional echocardiography before PCI. Follow up echocardiogram was done at discharge and after 3 months of PCI to assess LV systolic function. For 2-dimensional echocardiography, a vivid 7 system with phase array probe (3.5 MHz) was used. Estimates of LV end systolic volume (ESV) and ejection fraction (EF) were obtained from the average of three consecutive cardiac cycles taken from apical four chamber view using the modified Simpson's rule. Measurements were performed off-line by two independent echocardiographers who were blind to each other. Mean values from two independent reporters were taken as final value. Data was collected in a pre-designed form.

Statistical Analysis:

Statistical analyses were carried out by using SPSS (the Statistical Package for Social Sciences version 22 for Windows). Categorical variables were expressed in percentage. Continuous variables were expressed in mean±SD (Standard deviation). Baseline echocardiographic findings were compared with those at discharge and 3 month with paired Student t test. P value <0.05 was considered as statistically significant.

Results:

This study evaluated effect of late percutaneous coronary intervention on left ventricular systolic function after acute AMI in terms of LVESV and EF at baseline and after 3 months.

Demographic profile of the study population:

Figure-1 shows the age distribution of the study patients, most of the patients belonged to 51-60 years age group. Mean age 54.3±8.91 years, minimum age 30 and maximum 75 years.

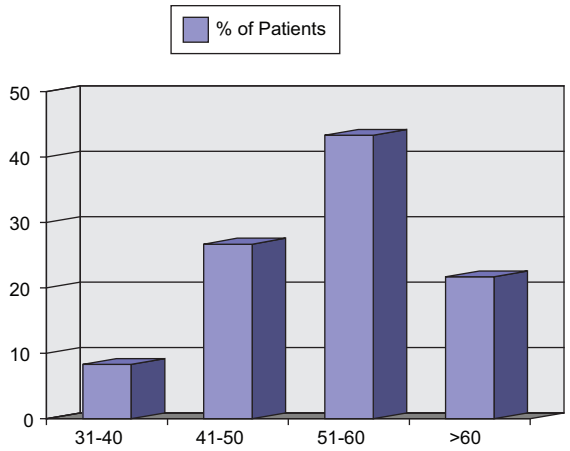

Fig.-1: *Age distribution of the study patients (n=60)*

Figure-2 showed the sex distribution of study patients. Males were predominant with male to female ratio being 2:1.

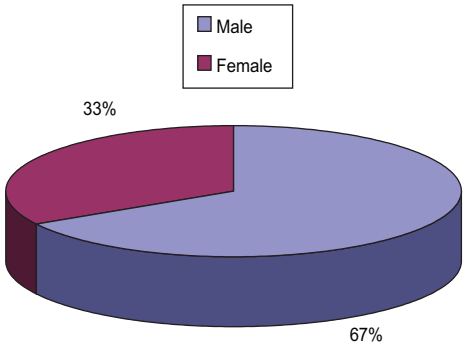

Fig.-2: *Sex distribution of the study patients (n=60)*

Table-1 shows the risk factors of the study patients.

Table-I

Distribution of the study patients by risk factors (n=38)

Risk factors	Number	Percentage (%)
Diabetes mellitus	17	28.3
Hypertension	24	40.0
Dyslipidemia	11	18.3
Smoking	8	13.3

n= Number of patient (60)

Table-2 shows the comparison of echocardiographic parameters before PCI and at discharge of the studied patients. LVESV& EF did not show significant change from baseline to at discharge.

Table-II

Comparison of echocardiographic parameters before PCI and at discharge

Echo-cardiographic variables	Before PCI (n=60)	At discharge (n=60)	P value
LVESV(ml)	60.0±14.4	58.3±15.3	.091^{ns}
EF(%)	40.2±3.1	40.2±3.3	.509^{ns}

Paired t-test were performed to compare the echocardiographic variables before PCI and at discharge.
SD= Standard déviations
ns= Non Significant
n= Number of patient (60)
LVESV= Left Ventricular End Systolic Volume , EF= Ejection Fraction

Table-3 shows the comparison of echocardiographic parameters before PCI and after 3 months of PCI. LVESV significantly reduced and LVEF significantly improved.

Table-III

Comparison of echocardiographic parameters before PCI and three months post PCI

Echo-cardiographic variables	Before PCI (n=60)	After 3 months (n=59)	P value
LVESV(ml)	60.0±14.4	44.1±17.6	<0.001s
EF(%)	40.2±3.1	47.6±5.9	<0.001s

Data were expressed as mean±SD
Paired t-test were performed to compare echocardiographic variables before PCI and after 3 months.
SD= Standard Deviation
S= Significant.
n= Number of patient (60)
n= Number of patient (59)
LVESV= Left Ventricular End Systolic Volume , EF= Ejection Fraction

Discussion:

Percutaneous coronary intervention (PCI) is the treatment of choice in patients presenting with acute myocardial infarction.

In this study, we assessed 60 anterior MI patients by echocardiography before and after PCI. Significant improvement in LVEF was found after 3 months of intervention.

Silva et al.[3] have shown that late recanalization, 12 hours to 14 days post anterior MI improved LVEF and myocardial contractility. Buszman et al.[4] revealed that LVEF was increased 6±7.2 % after PCI. Improvement of LVEF was seen in other study by Ioannidis et al[5]., LVEF improved from 40±17% to 54±15% in Remmelink et al[6]. and from 48.8±11.6% to 52.5±11.5% in Agirbasli et al.[7] study. Banerjee et al.[8] in another study reported that late PCI on persistent total occlusion 3-28 days after MI did not observe any change in LVEF compared with optimal medical therapy. On the other hand, Carluccio et al.[9] demonstrated that PCI improved LVEF (from 32% to 43%; *P*=0.0004).

In this study in Bangladeshi people, out of 60 patients one patient died. In this study, mean LVESV before PCI was 60.0±42.7ml but at discharge was 58.3±15.3ml, which is not statistically significant (p value =0.091). Horie et al.[10] documented mean LVESV at baseline 34.6±10.6 ml decreased to 31.1±11.2 ml after one month (p > 0.05).

In this study, mean EF before PCI was 40.2±3.1% but at discharge was 40.2±3.3%, which is not statistically significant (p value =0.509). Horie et al.[10] documented mean EF at baseline 48.5±8.65% increased to 53.9±8.96% after one month (p = 0.01). Nozari et al.[11] conducted a study where earliest interval of MI and PCI was 3 weeks. Mean EF increased before PCI to at discharge from 40.52±6.36% to 41.83±7.14% (p =0.143).

In this study, mean LVESV before PCI was 60.0±14.4ml but at 03 month of PCI was 44.1±17.6ml, which is statistically significant (p value <0.001). Baks et al.[12] demonstrated mean end systolic volume index decreased significantly from 34±13 ml/m^2 to 31±13 ml/m^2 (p = 0.02) after 5 months of PCI.

In this study, mean EF before PCI was 40.2±3.1% but at 03 month of PCI was 47.6±5.9%, which is statistically significant (p value <0.001). Baks et al.[12] demonstrated overall mean ejection fraction remained unchanged from 61±9% to 62±11% (p=0.54) after 5 months of PCI. Nozari et al.[11] conducted a study where earliest interval of MI and PCI was 3 weeks. Mean EF increased before PCI to at 3 months from 40.52±6.36% to 44.0±7.89% which was highly significant (p <0.001).

Mean value of LVESV was higher and mean value of LVEF was lower in this study in comparison to Horie at al.[10] probably because of anterior MI, LV dysfunction and only LAD involvement were the selection criteria.

Conclusion:

It is concluded that Late percutaneous coronary intervention in AMI (anterior) improves left ventricular systolic function. Further multicentric study on large sample size and for long duration is needed.

Limitations

The study has some limitations:

1. This study was performed only for a short period.
2. This study was done in highly selective group of patients comprising small cohort in one hospital only, which may not reflect the true picture of Bangladeshi patients.
3. Multicentric study was not done.

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