

ORIGINAL ARTICLE

Changes in Echocardiographic profile of NSTEMI patients, before and after PCI in Diabetes vs. Non-Diabetes group

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Abstract:

Background: Revascularization may improve outcomes of patients with LV dysfunction by improvement of EF. Though this is not so, in diabetic patients. Because diabetic ischemic etiology is consistently reported as a risk factor for lack of ejection fraction (EF) improvement after revascularization. The determinants of EF improvement havenot yet been investigated comprehensively among diabetic vs nondiabetic group. The goal of the study was to examine how diabetic and non-diabetic patients' left ventricular systolic performance change from the beginning of the trial to three months following PCI.

Methodology: This comparative clinical study, conducted at Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, from January to December 2018 with IRB clearance (Protocol No: BSMMU/2017/6624), adhered to Helsinki declaration principles. Patient selection based on inclusion/exclusion criteria involved comprehensive history-taking and clinical examinations. Transthoracic 2D echocardiography was performed pre-PCI, at discharge, and 3 months post-PCI using validated measurements. Left ventricular function parameters were assessed, and coronary angiography preceded percutaneous coronary intervention (PCI) with newer drug-eluting stents. Standard procedural techniques and anticoagulation were employed, maintaining medication consistency to minimize confounding variables.

Results: In our study, diabetic patients significantly improved systolic function, after PCI, to the point where it was nearly comparable to non-diabetics. Most of these measures were poorer in diabetics than in non-diabetics at baseline. However, in this subgroup, our study also demonstrated excellent reversibility of these negative effects following PCI. After PCI, there was also a change in LVEF in non-diabetics. Both people with diabetes and people without diabetes showed improvement in WMA. However, the degree of improvement in these two groups varied.

Discussion: This study compared coronary stenosis in diabetic and non-diabetic patients. Diabetics exhibited significantly higher LAD stenosis (60% vs. 40%), while RCA and LCx stenoses were similar. Baseline LVEF, LVESV, and LVIDs showed no significant differences between groups. Diabetics had more regional wall motion abnormalities. Three months post-PCI, both groups improved in LV parameters, with no significant inter-group differences. Diabetic patients showed improved LVEF, contrary to a study by Nabati et al. in non-diabetics. Regional wall motion abnormalities decreased more in non-diabetic patients

Conclusion: Contrary to the common belief favoring CABG for diabetics, our study indicates that newer drug-eluting stents offer comparable benefits in clinical outcomes, survival rates, and LV systolic function improvements for both diabetic and non-diabetic patients.

Keywords: NSTEMI, PCI, Diabetes, NSTEMI without Diabetes, NST ACS.

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Introduction:

Myocardial infarction, a potentially fatal medical emergency, occurs when blood flow to a region of the

myocardium is stopped entirely. Myocardial infarction could be "silent," could go unnoticed, or it could have a devastating occurrence, that might cause hemodynamic

degeneration and abrupt death.[1] When the heart's need for oxygen cannot be satisfied, a Non-ST-Elevation Myocardial Infarction (NSTEMI) typically occurs.^{2,3}

NSTEMI, which typically results from a partial coronary artery blockage or blockage in a branch of the primary coronary artery, can occur in people with heart attack symptoms with no ST elevation.⁴ Although there are some electrical pattern abnormalities that are frequently seen with NSTEMI, they are frequently not as noticeable, making other tests far more crucial in the diagnosis of NSTEMI.⁵

Acute coronary syndromes without ST-segment elevation in diabetic patients are associated with a greater risk of later cardiovascular events.⁶ Patients with diabetes mellitus rarely choose other treatment options, apart from Drug eluting stents.

Interestingly enough, after PCI, the echocardiographic profile of the NSTEMI patients- both diabetic or non-diabetic, had a distinctive change.^{7,8} This study is designed to determine the changes in this echocardiographic profile in diabetic patients, in comparison to that of the non-diabetic patients.

Materials and methods:

This comparative clinical study was carried out in the Department of Cardiology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from January 2018 to December 2018, after IRB Clearance (Protocol No: BSMMU/2017/6624)

Patients were chosen for this study based on inclusion and exclusion criteria, which were followed in accordance with the principles of the Helsinki declaration. History was obtained from each patient and from the patient's original paperwork. For each patient, a thorough clinical examination was conducted.

Transthoracic 2D echocardiography was performed at baseline within 24 hours before PCI, during discharge and repeated 3 months after PCI for all patients. All of the measurements represent the average of three consecutive beats between normal heart rate (ranges 60-100 bpm). An echocardiographer who had no knowledge of the patient, validated the findings after the images were. Poor echo window patients were not permitted to participate in the trial. LV short-axis dimensions with the transducer in the parasternal position were used to estimate the LV systolic dimensions. The ejection fraction (calculated by Teicholtz's and modified technique of Simpson's), LVESV, LVEDV, LVIDd, LVIDs and wall motion abnormalities (WMA) was determined in vivid E9 (GE Healthcare) echo machine with 1.5-4.6 MHz transducer.

Left Ventricular function was evaluated by following parameter with their normal values:

LVIDd: 37-56 mm, LVIDs: 26-36 mm, LVEDV: 85+-15 ml/m², LVESV: 35+-5 ml/m²

Ejection fraction: 50-70% . Fasting blood samples were taken, and Coronary angiography was performed for all of the patients using a cardiac angiography system and they all underwent PCI. PCI was performed by standard techniques and newer generation of drug eluting stents were used.

Unfractionated heparin was utilized for procedural anticoagulation, and glycoprotein IIb/IIIa inhibitors were used as necessary. Prior to the intervention, patients received 180 mg of ticagrelor. Following that, 90mg of ticagrelor twice daily and 75mg of aspirin daily were recommended. In order to reduce the impact of changes on the echocardiographic variables, other common medications (beta blockers, statins, and oral hypoglycemic agents) are kept the same throughout the trial.

Results:

Echocardiographic evaluation before PCI

Left ventricular ejection fraction (LVEF) was on an average 1.6% lower in diabetic group than that in non-diabetic group ($p = 0.07$). Number of segments with abnormal wall motion (WM) was much higher in the diabetics than that in the non-diabetics ($p = 0.014$). The left ventricular end diastolic volume (LVEDV), the left ventricular end systolic volume (LVESV) was no different between the groups ($p = 0.076$ and $p = 0.368$ respectively). Left ventricular internal dimension in diastole (LVIDd) and left ventricular internal dimension in systole (LVIDs) were higher in the diabetics than those in the non-diabetics ($p < 0.001$ and $p = 0.046$ respectively)

Echocardiographic evaluation at discharge after PCI

No significant improvement was noted in either group at discharge after PCI in terms of LVEF, number of segments with abnormal wall motion (WM), LVIDd and LVIDs. However, both LVEDV and LVESV decreased substantially in both groups with decrease of LVESV were much quicker in the non-diabetic group compared to that in diabetic group ($p = 0.018$)

Echocardiographic evaluation of LV systolic function 3 months after PCI after 3 months of PCI, LVEF increased in both groups from their baseline figures with number of

abnormal WM segments decreased. LVEDV decreased further with decrease being more pronounced in the non-diabetic group. So the two groups became almost identical in terms this variable ($p = 0.221$). LVESV and LVIDd both further decreased in either group maintaining significant difference between the groups with respect to these variables as before ($p = 0.017$ and $p = 0.008$ respectively). However, LVIDs did not respond much and the difference between the groups in terms of this variable remained insignificant ($p = 0.060$).

Difference in LV function parameters from baseline to 3 months after PCI in DM vs non-DM:

Changes in LV function parameters from baseline to 3 months after PCI shows that there is no difference between diabetics and non-diabetic in terms of percentage of improvement in LVEF, percentage of decrease in LVEDV, LVESV and LVIDs ($p = 0.631$, $p = 0.657$ and $p = 0.088$ respectively). The percentage of decrease in WMA, LVIDd, LVIDs were no different between diabetic and non-diabetic group ($p = 0.061$, $p = 0.210$ and $p = 0.201$ respectively).

Discussion:

In this study, diabetic patients have significant LAD stenosis (60%) than non-diabetics (40%); $p = 0.133$. The significant stenoses in the RCA and LCx were, however, almost identical between groups ($p = 0.683$ and $p = 0.909$ respectively)

All patients were assessed by 2D echocardiography before PCI, at discharge and 3 months after PCI. At baseline, diabetic patients had LVEF $53.9 \pm 3.8\%$, where as non-diabetics had $55.5 \pm 4.7\%$, but the difference was not statistically significant ($p = 0.070$). There was also no significant difference in LVESV and LVIDs in between DM and non-DM group ($p = 0.368$, $p = 0.06$ respectively). Regional wall motion abnormality was present more in diabetics than non-diabetics ($p = 0.014$)

On follow up 3 months after PCI again, we found that there was improvement of all parameters of LV systolic function in both groups. From baseline to 3 months after PCI, LVIDs decreased in both diabetes $5.7 \pm 1.9\%$ and non-diabetics $4.8 \pm 1.1\%$ but the difference between these two groups is not significant ($p = 0.201$)

We found more regional wall motion abnormality (WMA) in diabetic 2 ± 1 than non-diabetic groups 1 ± 1 ($p = 0.014$) at baseline. 3 months after PCI, WMA in diabetes 1 ± 1 and in non-diabetic 0.03 ± 0.02 ($p = 0.01$) and WMA decreased $86.7 \pm 8.0\%$ in diabetic whereas $96.0 \pm 4\%$ decreased in non-diabetics ($p = 0.061$)

In our study, from baseline to 3 months after PCI, LVEF improved $8.4 \pm 1.2\%$ in diabetics and $7.9 \pm 1.2\%$ in non-diabetics from baseline but the difference of this improvement between two groups is not statistically significant ($p = 0.631$). Nabati et al., 2016 found that 1 month after PCI diabetic patients improved in LVEF, but non diabetic patient didn't show any significant improvement in LVEF ($p = 0.004$)

Conclusion:

It was widely believed that CABG would provide superior results for diabetic individuals. But according to our study, the newer generation of drug-eluting stents is advantageous for diabetic patients in terms of clinical outcomes, survival rates, and improvements to LV systolic function, just as it is for the non-diabetic group.

Author Contributions: All authors participated in manuscript preparation, revising and drafting.

Conflicts of interest: The authors have none to declare.

Data & Materials: Available from the corresponding author, on reasonable request.

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