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Research Article

# Effect of percutaneous coronary intervention in diabetic patients with non-ST elevated myocardial infarction

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## Abstract

**Background:** Diabetic patients with Non ST Elevated Myocardial Infarction (NSTEMI) are at high risk for subsequent cardiovascular events. But, early Percutaneous Coronary Intervention (PCI) in high risk group of NSTEMI patients significantly prove the primary outcomes.

**Objective:** The aim of the study was to evaluate the changes in Left Ventricular (LV) systolic function after successful PCI in diabetic patients with NSTEMI compared to non diabetic group.

**Methods:** From January 2018 to December 2018, this comparative clinical study was carried out in the Department of Cardiology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. Diabetic and non-diabetic patients (30 and 34 respectively) with NSTEMI undergoing PCI were included in the study. Successful PCI with drug eluting stent was performed for all patients. Transthorasic echocardiography was done at baseline, at discharge following PCI and 3 months thereafter to measure the LV systolic functions and compare them between diabetics and non-diabetic group to assess the outcome of intervention.

**Results:** At baseline Left Ventricular Ejection Fraction (LVEF) was somewhat lower in diabetic group than that in non-diabetic group. Three months after PCI, LVEF improved 8.4±1.2% in dibetics and 7.9±1.2% in non dibetics but the difference of this improvement between two groups was not statiscally significant (p = 0.631).

**Conclusion:** Statistically similar improvement was observed in left ventricular systolic function after PCI with stenting in diabetic and non diabetic patients with NSTEMI. So, indications of PCI with stenting may be extended in diabetic patient with NSTEMI.

## Introduction

In total, 15-20% of patients who undergo coronary revascularization are diabetic [1,2]. The long-term results of Percutaneous Coronary Intervention (PCI) and Coronary Artery Bypass Graft (CABG) are less favorable in diabetic patients [3]. This outcome is most likely due to a faster progression of atherosclerosis and a higher rate of restenosis [4]. While the use of drug eluting stents has improved the short and long term outcomes of PCI in diabetic patients [5].

There are many studies showed, long term clinical outcome and survival benefit of drug eluting stent in patients with diabetes compared to non diabetics. Few studies have compared the echocardiographic systolic parameters between diabetics and non-diabetic patients with STEMI which showed that



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PCI on Left Coronary Artery (LAD) or Left Circumflex artery (LCx) in STEMI patients induced further improvement in Left Ventricular Ejection Fraction (LVEF). But, there is lack of study to compare left ventricular systolic function between diabetic and non diabetic patients with NSTEMI undergoing PCI. Therefore, this study was designed to determine the changes in left ventricular systolic function after successful PCI with drug-eluting stenting after NSTEMI in diabetic patients compared with non-diabetic patients.

## Materials and method

From January 2018 to December 2018, this study was carried out in the Department of Cardiology, University Cardiac Center, Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag, Dhaka, Bangladesh. Diabetic and non-diabetic patients (30 and 34 respectively) with non-STEMI undergoing percutaneous coronary intervention were included in the study. All patients were assessed by 2D echocardiography, then alterations in the echocardiographic variables after the procedure were compared between the two groups.

The study was performed according to the guidelines of the Helsinki Declaration and was approved by the University ethical committee. Written informed consent was obtained from all of the patients. Patients who were diagnosed as NSTEMI included in this study. However, patients with chronic stable angina, unstable angina, ST elevated myocardial infarction, congenital heart disease, significant valvular heart disease (equal or more than moderate severity), cardiomyopathy and atrial fibrillation, systemic diseases, such as cancer, collagen vascular diseases or amyloidosis, renal impairment were excluded from the study.

### Echocardiography

Transthoracic echocardiography was performed at baseline within 24 hour before PCI, at discharge and was repeated 3 months after PCI for all patients by a Vivid E9 version: 113 (GE Healthcare, Norway), 1.5-4.6MHz transducer. Estimation of the LV systolic dimensions were derived from the LV minor-axis dimensions with the transducer in the parasternal position. So that the cursor was perpendicular to the interventricular septum and posterior wall at the mid-papillary muscle level. The EF and Wall Motion Abnormalities (WMA) were determined. The EF was defined as the end diastolic volume minus the end systolic volume divided by the end diastolic volume from biplane apical two and four chamber views using a modified Simpson's technique.

Coronary angiography was performed for all of the patients using a cardiac angiography system (Siemens AG, Medical Solutions, Erlangen, Germany), and they all underwent PCI. PCI was performed by standard techniques, and newer generation of drug eluting stents were used.

Procedural success was defined as the successful deployment of the stent and residual stenosis of less than 10% [6]. Procedural anticoagulation was achieved with unfractionated heparin; glycoprotein IIb/IIIa inhibitors were used whenever needed. Patients received 180mg of Ticagrelor before the intervention. Thereafter, 75mg of aspirin daily and 90mg of Ticagrelor twice daily were prescribed. Other standard drugs (angiotensin converting enzyme inhibitors, beta blockers, statins and oral or injectable hypoglycemic agents) remained unchanged during the study in order to minimize the effects of alterations on the echocardiographic variables.

### Statistical analysis

Desscriptive statistics were used. Data presented on categorical scale were compared between groups using chi-square ($x^2$). Continuous and normally distributed data were compared between groups with unpaired t-test. For analytical tests level of significance was set at 5% and p - value <0.05 was considered significant. Sample size for both diabetic and non-diabetic group was calculated from the values of previous study [7]. Data were processed and analysed using SPSS (Statistical Package for Social Sciences), version 25.0.

## Results

In this study more than half (56.7%) of the subjects in the diabetic group and two-thirds (67.6%) in the non-diabetic group were 50 or <50 years old with no significant difference (p = 0.365). In gender distribution, a male predominance was observed in both group (p = 0.386) (Table 1).

Diabetic group had a significantly higher mean fasting blood sugar than the non-diabetic group (p < 0.001). The mean HbA1c was also significantly higher in the former group than that in the latter group (p < 0.001). However, none of the serum lipids shown in table were any different between the study groups (p > 0.05) (Table 2).

Before PCI, Left Ventricular Ejection Fraction (LVEF) was on an average 1.6% lower in diabetic group than that in non-diabetic group (p = 0.070). Number of segments with abnormal Wall Motion (WM) was much higher in the diabetics than that in the non-diabetics (p = 0.014). While 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

**Table 1:** Distribution of patients by their demographic Characteristics.

| Demographics* | Group | | p - value |
|---|---|---|---|
| | Diabetic (n = 30) | Non-diabetic (n = 34) | |
| Age (years) | | | |
| ≤ 50 | 17(56.7) | 23(67.6) | 0.365 |
| > 50 | 13(43.3) | 11(32.4) | |
| Sex | | | |
| Male | 21(70.0) | 27(79.4) | |
| Female | 9(30.0) | 7(20.6) | 0.386 |

Figures in the parentheses indicate corresponding %.
*Chi-squared test ($\chi^2$) was done to analyze the data.

**Table 2:** Distribution of patients by their laboratory investigation findings.

| Laboratory investigations# | Group | | p - value |
|---|---|---|---|
| | Diabetic (n = 30) | Non-diabetic (n = 34) | |
| FBS (mmol/L) | 9.3±2.0 | 5.5±0.07 | <0.001 |
| HbA1c (%) | 7.5±1.0 | 4.9±0.5 | <0.001 |
| S. Cholesterol (mg/dl) | 188.0±42.5 | 200.5±50.8 | 0.292 |
| LDL (mg/dl) | 127.1±27.6 | 136.4±32.2 | 0.219 |
| HDL (mg/dl) | 36.5±5.2 | 35.5±4.7 | 0.424 |
| Triglycerides (mg/dl) | 230.7±59.1 | 212.9±69.3 | 0.276 |

#Data were analyzed using unpaired t-test and were presented as mean±SD.



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Dimension In Diastole (LVIDd) and Left Ventricular Internal Dimension In Systole (LVIDs) were also higher in the diabetics than those in the non-diabetics ($p < 0.001$ and $p = 0.046$ respectively) (Table 3).

After three 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 ($p = 0.060$) (Table 4).

Changes in LV function parameters from baseline to 3 months after PCI shows that there is no difference between diabetics and non-diabetics 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 are no difference between diabetic and non diabetic group ($p = 0.061$, $p = 0.210$ and $p = 0.201$ respectively) (Table 5).

**Table 3:** Echocardiographic evaluation of left ventricular systolic function before PIC.

| Left ventricular systolic function parameters# | Group | | p - value |
|---|---|---|---|
| | Diabetic (n = 30) | Non-diabetic (n = 34) | |
| LVEF (%) | 53.9±3.8 | 55.5±4.7 | 0.070 |
| No. of segments with abnormal WM | 2±1 | 1±1 | 0.014 |
| LVEDV (ml) | 96.0±8.1 | 94.4±8.4 | 0.076 |
| LVESV (ml) | 44.3±2.9 | 42.1±3.5 | 0.368 |
| LVIDd (mm) | 51.9±4.5 | 49.4±3.4 | <0.001 |
| LVIDs (mm) | 35.1±5.4 | 32.6±4.5 | 0.046 |

#Data were analyzed using unpaired t-test and were presented as mean±SD.

**Table 4:** Echocardiographic evaluation of LV systolic function 3 months after PIC.

| LV systolic function parameters# | Group | | p - value |
|---|---|---|---|
| | Diabetic (n = 30) | Non-diabetic (n = 34) | |
| LVEF (%) | 57.8±2.3 | 59.3±2.6 | 0.027 |
| No. of segments with WMA | 1±1 | 0.03±0.02 | <0.001 |
| LVEDV (ml) | 74.9±22.7 | 68.3±19.5 | 0.221 |
| LVESV (ml) | 31.6±10.5 | 27.8±8.7 | 0.017 |
| LVIDd (mm) | 50.2±2.3 | 48.1±2.6 | 0.008 |
| LVIDs (mm) | 33.1±2.6 | 31.2±4.8 | 0.060 |

#Data were analyzed using unpaired t-test and were presented as mean±SD.

**Table 5:** Difference in LV function parameters from baseline to 3 months after PCI in DM Vs non DM.

| LV systolic function parameters# | Group | | p - value |
|---|---|---|---|
| | Diabetic (n = 30) | Non-diabetic (n = 34) | |
| % of increase in LVEF (%) | 8.4±1.2 | 7.9±1.2 | 0.631 |
| % of decrease in no. of segments with WMA | 86.7±8.0 | 96.0±4.0 | 0.061 |
| % of decrease in LVEDV (ml) | 22.6±3.6 | 24.8±3.3 | 0.657 |
| % of decrease in LVESV (ml) | 26.6±4.1 | 29.1±3.1 | 0.088 |
| % of decrease in LVIDd (mm) | 3.6±1.0 | 3.9±1.4 | 0.210 |
| % decrease in LVIDs (mm) | 5.7±1.9 | 4.8±1.1 | 0.201 |

#Data were analyzed using unpaired t-test and were presented as mean±SD.

## Discussion

The study was conducted to compare the changes in left ventricular systolic function from baseline to three months after PCI between diabetic and non-diabetic patients.

At baseline, diabetic patients had LVEF 53.9±3.8% where as non diabetics had 55.5±4.7%, but the difference was statistically not significant ($p = 0.07$). There was also no significant difference in LVESV and LVIDs in between DM & non DM group ($p = 0.368$, $p = 0.06$ respectively).

On follow up three months after PCI again we assessed by 2D echocardiography and found that, there was improvement of all parameters of LV systolic function in both dibetic and non dibetic group. From baseline to three months after PCI LVIDs decreased in both diabetics 5.7±1.9% and non diabetics 4.8±1.1% but the difference between these two goups is not significant ($p = 0.201$).

In 2016 Nabati, et al. [8] found that, in diabetic group baseline & 1 month after PCI, LVIDs was 31±6.3 & 28±5.8 respectively and 10% decrement occured of LVIDs ($p = 0.002$) in this group. Where as in non diabetic group baseline and 1 month after PCI LVIDs was 28±4.1 and 30.9±6.6 respectively and 8% increament occur of LVIDs. Our study is consistent with this findings.

At baseline we found, more regional Wall Motion Abnormality (WMA) in diabetic 2±1 than non diabetic groups 1±1 ($p = 0.014$). Three months after PCI WMA in dibetics 1±1 and in non diabetic 0.03±0.02 ($p = <0.001$) and WMA decresed 86.7±8.0% in dibetic where as 96.0±4% decreased in non dibetics ($p = 0.061$).

Nabati, et al. 2016 [8], found that before PCI, the WMA was in 2.2±2.91 segments that significantly decreased to 1.5±2.58 segments ($p = 0.04$) after the procedure. However, there was no significant difference in WMA improvement between the diabetics and non-diabetics, (before PCI: 2.69±2.96 and 1.77±2.86 and after PCI: 1.69±2.9 and 1.33±2.24 segments respectively ($p = 0.4$). This results consistent wirh our findings.

In our study we found, baseline to 3 months after PCI LVEF improved 8.4±1.2% in dibetics and 7.9±1.2% in non dibetics but the difference of this improvement between two groups is not statiscally significant ($p = 0.631$). Nabati, et al. 2016 [8], found that 1 month after PCI diabetic patients improved in LVEF, but non diabetic patient didn't show any significant imporvement in LVEF ($p = 0.004$)

Agirbasli, et al. 2005 [9], found similar result, where he evaluated LV contractility and myocardial perfusion after PCI in 60 patients who underwent successful LAD stenting. Myocardial perfusion and LVEF improved at 6±3 months after the procedure ($p = 0.05$).

In our study, diabetics showed significant improvement in the parameter of the ystolic function such as LVIDd, LVIDs, LVEDV, LVSDV and LVEF as almost equal to non-diabetics. At baseline, most of these parameters were worse in diabetics



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compared to non-diabetics. This outcome may be due to a worse effect of diabtetes on ischemia. However, our study also showed excellent reversibility of these adverse effects after PCI in this subgroup [10].

In non-diabetics, there was also change in LVEF after PCI. WMA improvement was observed in both diabetics and non-diabetics. Though, there was varing degree of improvement in this two groups. For such variation, the worse baseline echocardiographic parameters in diabetic patients may be the cause.

However, our study has some limitations as its a single center study with small sample size.

## Conclusion

Statistically similar improvement was observed in left ventricular systolic function after PCI with stenting in diabetic and non diabetic patients with NSTEMI. So, indications of PCI with stenting may be extended in diabetic patient with NSTEMI.

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