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Original Article

# Short Term Prognosis in Patients with Diabetes Mellitus after Coronary Revascularization

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## ABSTRACT

**Background:** Cardiovascular disease often advances rapidly in people with diabetes mellitus, resulting in unfavorable clinical outcomes and complications after revascularization procedures. The purpose of our study was to determine how baseline parameters and Diabetes Mellitus (DM) affected clinical outcomes in the immediate aftermath of revascularization. **Materials and Methods:** For this investigation, 189 patients who underwent CABG (Coronary Artery Bypass Graft) and PCI (Percutaneous Coronary Intervention) operations for revascularization during a five-month period in a South Indian tertiary care hospital were the subject of a hospital-based prospective observational analysis. During the first 30 days following revascularization, patients were assessed for clinical outcomes and baseline characteristics in the diabetic and non-diabetic groups. To ascertain the relevance of the findings, statistical analyses were carried out. **Results:** The study reveals that there is no statistically significant difference in the type of surgery, number of grafts or stents, urgency of the surgery, angiographic finding, length of ventilation, volume of the chest drain, stay in the cardiothoracic unit, and length of hospitalization between the diabetes and non-diabetic cohorts. Arrhythmia, stroke after revascularization, re-exploration within discharge mortality, pulmonary embolism, hemorrhage, perioperative mortality, and postoperative mortality within 30 days were evaluated as follow-up events in both the groups and determined to be insignificant. **Conclusion:** Even though prevalence of Cardiovascular Disease (CVD) is higher in diabetics, when comparing the diabetic and non-diabetic cohorts, it is not regarded as a risk factor for any negative outcomes following revascularization immediately within a period of thirty days following the angioplasty.

**Keywords:** Coronary artery bypass graft, Coronary Revascularization, Diabetes mellitus, Clinical outcome, Coronary artery disease, Percutaneous coronary intervention.

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## INTRODUCTION

In the modern world, diabetes presents enormous health and financial difficulties, particularly in underdeveloped nations. In 2021, there were approximately 53.7 billion persons worldwide had diabetes particularly with India having the second-highest number of such individuals (7.42 billion).[1,2] It affects quality of life and the development of a wide spectrum of complications, including cardiovascular risk. Compared to people without diabetes, cardiovascular mortality rate is twice as high in patients with diabetes.[3,4] The pathological profile of coronary lesions in diabetic individuals with CVD is more complex and is characterized by calcified, diffuse, multivessel disease and a greater burden of atherosclerotic plaques.[5] As a result, these patients require revascularization and assessment of their coronary lesions, in addition to obtaining the finest medical care possible.[6]

Clinicians have become increasingly concerned about the epidemiological transition, rising prevalence of diabetes as a key risk factor for CAD, and choice of treatment plan. Revascularization using two techniques CABG Coronary Artery Bypass Graft (CABG) and Percutaneous Coronary Intervention (PCI), has generated a great deal of interest in these treatment options as possible measures for this high-risk patient population. This is because patients with diabetes account for one-fourth of the 1.5 million revascularizations performed each year.[7,8] Following the advent of new oral antiplatelet medications and drug-eluting stents (DES), there was a significant decrease in the clinical results of the two techniques involved. [9,10]

The optimal revascularization approach for individuals with diabetes and CVD is still unknown, despite the introduction of DES and a decrease in repeat revascularization and in-stent restenosis compared with bare-metal stents.[11] The present study was carried out in a South Indian tertiary care hospital to compare

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the short-term clinical outcomes following revascularization in a cohort of patients with and without diabetes following percutaneous coronary intervention or coronary artery bypass graft.

## MATERIALS AND METHODS

### Study Population

Patients with CVD who were hospitalized for revascularization at the Cardiology Department of Kovai Medical Center and Hospital (KMCH), Coimbatore, were included in this prospective study. The study received approval from Institutional Ethical Committee (reference number EC/AP/907/05/2022) of Kovai Medical Centre and Hospital for a period of five months. Informed consent from patients was obtained during study. Patients over 18 years old who had successful surgery between December 2022 and June 2023 were included in the study. Patients who had multiple surgical procedure (undergone previous cardiac surgeries, CABG with valvular intervention, peripheral arterial bypass grafting) were excluded. The baseline demographics, in-hospital outcomes, and clinical and procedural characteristics were all gathered prospectively from hospital records. Based on the revascularization method and the presence or absence of diabetes mellitus, each cohort was split into two groups and a subgroup. The patients within diabetes group included those who had confirmed diagnosis of diabetes and were on hypoglycemic treatments like insulin or oral anti diabetic medications. Patients were followed-up for the first 30 days since surgery, and major clinical outcomes were noted in both groups.

### Statistical Analysis

IBM SSPS version 22 was used to conduct statistical analysis of the data. This study presented a distribution that based on the revascularization technique in the diabetic and non-diabetic cohorts. Mean and Standard Deviation (SD) were used to describe the data for continuous variables. The percentages were calculated using the entire set of variables. The student's t-test was used to analyze baseline characteristics between different groups for continuous variables, while the chi-squared test method was used for discrete variables. $p$ values were considered two-sided, and statistical significance was set at $p<0.05$. Kaplan-Meier survival chart was plotted using log rank (Mantel-Cox) test. Mortality was considered as event occurred and survival time was referred as days elapsed. Graphical representation was used for the visual comprehension of the data collected.

## RESULTS

We enrolled two hundred twenty-eight patients who underwent successful revascularization in the study center, but only two hundred and three patients who satisfied our criteria were included. Fourteen patients were lost on the follow-up. In total, one hundred eight-nine people were chosen for the study (Figure 1).

Out of the total participants, 53.9% had diabetes mellitus, one hundred patients (52.9%) (diabetic: 60; non-diabetic: 40) were in the CABG arm and 89 patients (47.1%) (diabetic: 42; non-diabetic: 47) were in the PCI arm as shown in Figure 2.

Majority of patients were males. The subjects had a mean BMI of 25.2 kg/m$^2$ (Table 1) with a mean age of 60.5 years. In the CABG group, the smoking and alcohol consumption rates in the diabetes group were 13.3% and 11.7% respectively. Except for the history of hypertension, history of renal failure, urea level, and RBS level between the diabetic and non-diabetic groups, no statistically significant differences were observed. 50% of the study population had Myocardial Infarction (MI) history and 6.7% had a history of CVA. In the PCI arm, 46% of the study population had history of MI and 7.2% had a history of CVA (Table 1).

Categorization of the diabetes and non-diabetic group was performed based on hypoglycemia treatment. The mean blood glucose levels were calculated before and after surgery. HBA1C was estimated 7.9 in the CABG and 8.1 in the PCI arm. Compared with insulin treatment, OHA is preferred (Table 2).

Nearly all patients in the CABG arm, those with and without diabetes underwent off-pump surgery. Patients with diabetes received four grafts on average (46.67%), compared to three (45%) in the non-diabetic group. In the CABG group, triple-vessel disease was discovered to be significant in both diabetic and non-diabetic individuals (Table 3).

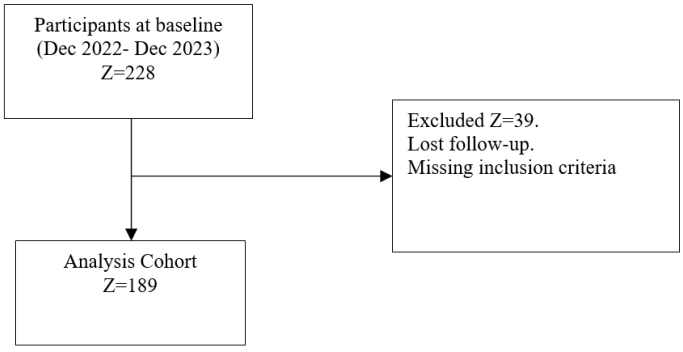


**Figure 1:** Sequence chart displaying selection procedure.

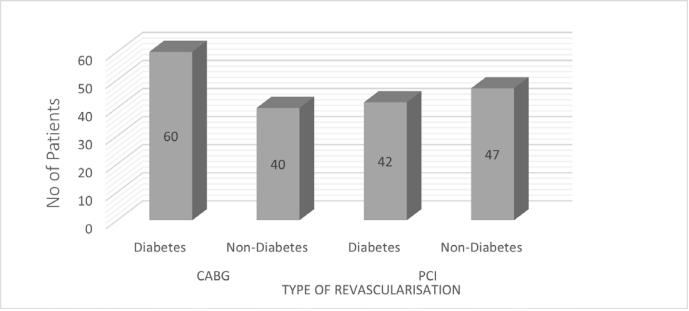


**Figure 2:** Bar chart displaying cohort layout under study.

**Table 1: Demographic characteristics of study population.**

| Parameters | CABG | | | PCI | | |
|---|---|---|---|---|---|---|
| | Diabetic (z=60) | Non-Diabetic (z=40) | *p* value | Diabetic (z=42) | Non-Diabetic (z=47) | *p* value |
| Age (years) | 60.5±8.0 | 60.9±9.0 | 0.803 | 61.2±10.9 | 60.12±12.9 | 0.833 |
| Male n (%) | 51(85.0) | 33(82.5) | 0.738 | 36(85.7) | 39(83.0) | 0.712 |
| BMI (kg/m$^2$) | 25.9±4.19 | 24.4±6.1 | 0.866 | 25.0±5.7 | 24.9±7.1 | 0.821 |
| Smoking (%) | 13.3 | 15.0 | 0.814 | 12.8 | 14.5 | 0.838 |
| Alcohol (%) | 11.7 | 5.0 | 0.254 | 16.2 | 9.0 | 0.199 |
| Hemoglobin (Hb) | 12.4±2.8 | 12.7±1.4 | 0.592 | 12.1±2.7 | 12.5±1.1 | 0.612 |
| Random Blood Sugar (mg/dL) | 155.6±11.4 | 73.6±64.1 | <0.001 | 159.2±13.3 | 79.3±42.8 | <0.001 |
| Sodium(mEq/L) | 136.1±3.3 | 138.1±2.3 | 0.03 | 136.9±4.6 | 134.9±3.9 | 0.012 |
| Potassium (mmol/L) | 4.47±0.317 | 4.3±0.29 | 0.089 | 4.4±0.2 | 4.1±0.4 | 0.099 |
| Thyroid-Stimulating Hormone (TSH) mIU/L | 2.4±2.0 | 2.0±1.8 | 0.405 | 2.2±1.6 | 2.4±2.1 | 0.416 |
| Fasting Blood Sugar (mg/dL) | 96.1±83.1 | 88.3±38.1 | 0.581 | 99.2±78.6 | 85.8±31.7 | 0.476 |
| Pre-Operative eGFR (%) | 93.3 | 95.0 | 0.461 | 94.0 | 95.8 | 0.434 |
| Creatinine post-surgery (mg/dL) | 1.2±0.6 | 1.1±0.7 | 0.623 | 1.0±0.5 | 1.0±0.8 | 0.578 |
| CVA n (%) | 6.7 | 5.0 | 0.731 | 7.2 | 6.0 | 0.811 |
| Antiplatelet agents | 95.6 | 92.4 | 0.347 | 98.0 | 96.2 | 0.234 |
| Myocardial infarction (%) | 50.0 | 55.0 | 0.624 | 46.0 | 51.0 | 0.645 |
| Hypertension n (%) | 56.3 | 30 | 0.002 | 61.3 | 49 | 0.012 |
| COPD n (%) | 0 | 5.0 | 0.081 | 5.0 | 2 | 0.345 |
| Ejection fraction n (%) | 49.2±12.0 | 52.8±9.3 | 0.122 | 50.3±9.9 | 51.4±11.8 | 0.234 |
| Renal failure n (%) | 10 | 5 | 0.367 | 4 | 0 | 0.234 |
| Cardiac surgery n (%) | 1.7 | 0.0 | 0.412 | 1 | 0 | 0.321 |
| Urea (mg/dL) | 34.4±24.3 | 26.5±8.5 | 0.05 | 34.4±24.3 | 26.5±8.5 | 0.04 |
| Neurological n (%) | 0.4 | 0.1 | 0.07 | 0 | 0 | 0 |
| Angiotensin-converting enzyme inhibitors/ Angiotensin receptor blockers | 42.7 | 37.5 | 0.677 | 43.7 | 36.9 | 0.511 |
| Statin | 92.3 | 86.5 | 0.348 | 90.5 | 91.3 | 0.209 |
| Calcium channel blockers | 25.0 | 22.5 | 0.774 | 26.5 | 23.9 | 0.445 |
| Creatinine on admission(mg/dL) | 1.0±0.6 | 1.0±0.9 | 0.899 | 1.0±0.3 | 1.0±0.7 | 0.865 |
| Beta-blockers | 52.7 | 46.5 | 0.673 | 55.3 | 49.7 | 0.456 |

*p* value lesser than 0.05 is considered statistically to be significant. Continuous variable is shown as mean±standard deviation. Categorical data are shown as n%. Continuous variable is shown as mean±standard deviation.

**Table 2: Clinical characteristics of DM study cohort.**

| Parameters | CABG (z=60) | PCI (z=42) |
|---|---|---|
| HbA1C | 7.9±1.5 | 8.1±09 |
| Duration of Diabetics (Months) | 86.1±81.5 | 80.1±75.5 |
| Oral Hypoglycemic Medications (OHA)+Diet (%) | 76.37 | 73.89 |
| Insulin+Diet (%) | 14.54 | 15.78 |
| Mean Blood glucose pre surgery (mg/dL) | 126.2±26.1 | 123.2±23.8 |
| OHA+Insulin+Diet (%) | 9.09 | 10.33 |
| Mean Blood glucose post discharge (mg/dL) | 146.4±36.3 | 144.8±34.7 |

Categorical data are shown as n%. *$p$ value lesser than 0.05 is considered statistically to be significant. Continuous variable is shown as mean±standard deviation.

**Table 3: Surgery characteristics in CABG patients.**

| Parameter | Diabetic (z=60) | Non- Diabetic (z=40) | *p* |
|---|---|---|---|
| Surgery type | | | |
| On-pump technique | 3.34 | 0 | 0.348 |
| Off-pump technique | 96.7 | 100 | |
| Number of grafts (%) | | | |
| 1 | 3.33 | 2.5 | 0.441 |
| 2 | 5 | 7.5 | |
| 3 | 26.67 | 45 | |
| 4 | 46.67 | 32.5 | |
| 5 | 16.67 | 12.5 | |
| 6 | 1.66 | 0 | |
| Urgency of surgery (%) | | | |
| Emergency | 3.34 | 45 | 0.239 |
| Elective | 96.66 | 55 | |
| Angiographic Findings (%) | | | |
| TVD | 81.7 | 87.5 | 0.648 |
| SVD | 8.3 | 7.5 | |
| DVD | 10 | 5 | |
| Hospital stay Duration (Days) | 7.9±2.4 | 7.1±1.7 | 0.077 |
| Duration of ventilation (**Hr**) | 8.7±6.2 | 6.9±4.4 | 0.128 |
| Chest Drain volume (ml) | 738.1±440.1 | 842.6±577.8 | 0.380 |
| CTU Duration (**Hr**) | 34.4±14.0 | 31.4±10.1 | 0.249 |

*p* value lesser than 0.05 is considered statistically to be significant. Continuous variable is shown as mean±standard deviation. Categorical data are shown as n%. Continuous variable is shown as mean±standard deviation.

In the PCI arm, 82% of patients with diabetes received stents compared to 79% of those without diabetes. In the PCI arm, both the diabetic and non-diabetic patients had single-vessel disease. In the PCI research cohort, hospital stays were of shorter periods (Table 4) compared to CABG.

After a 30-day follow-up period following surgery in patients after PCI and CABG, analysis of Kaplan-Meier survival curves (Figure 3) showed that both the patients with and without DM had higher and similar survival rates with a log-rank *p*-value of 0.99

**Table 4:** **Surgery characteristics in PCI study cohort.**

| Variables | Diabetic (z=42) | Non-Diabetic (z=47) | *p* |
|---|---|---|---|
| No of stents (%) | | | |
| 1 | 82 | 79 | 0.365 |
| 2 | 18 | 20 | |
| 3 | 0 | 1 | |
| Urgency of surgery (%) | | | |
| Emergency | 6.5 | 25 | 0.218 |
| | | | |
| Elective | 93.5 | 75 | |
| CTU duration (Hr) | 34.1±14.2 | 32.4±10.3 | 0.249 |
| Angiographic Findings (%) | | | |
| TVD | 8.4 | 6.0 | 0.349 |
| DVD | 13.1 | 10.0 | |
| SVD | 78.5 | 84.0 | |
| Duration of hospital stay (days) | 3.5±3.8 | 2.9±3.1 | 0.123 |

Categorical data are shown as n%. *$p$ value lesser than 0.05 is considered statistically to be significant. Continuous variable is shown as mean±standard deviation.

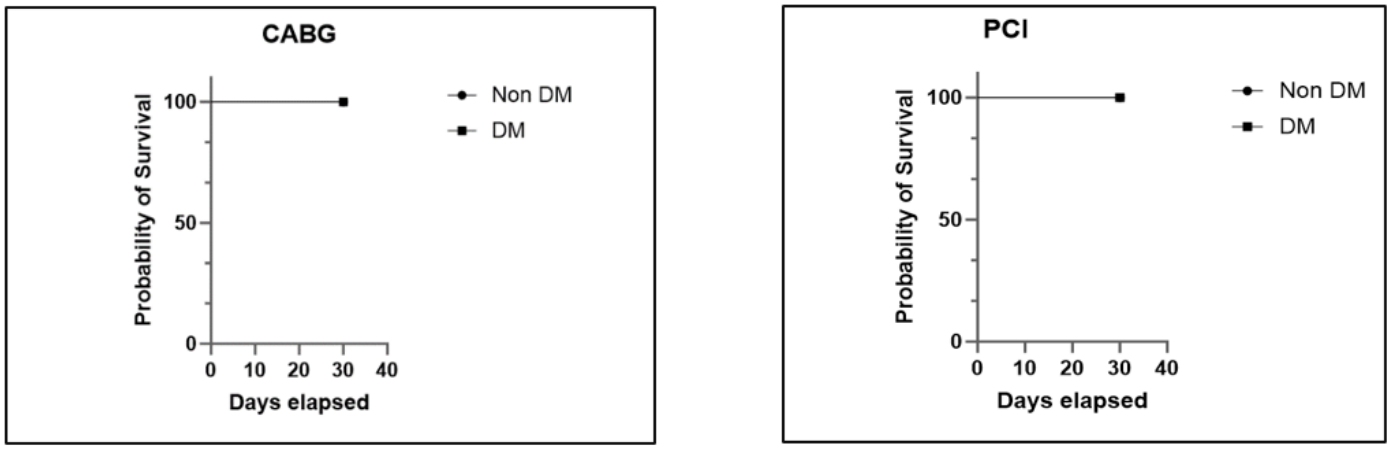


**Figure 3:** Probability plot of Kaplan–Meier survival estimates for CABG and PCI.

## DISCUSSION

Diabetes is considered as an independent risk factor for cardiovascular disorders. In those with diabetes mellitus, 80% of unexpected fatalities are mostly due to arteriosclerosis. Based on the several studies carried out, CABG was preferred for adverse CAD, but PCI was chosen for high operational risk factors such as diabetes mellitus, advanced age, and severe comorbidities.[12] When illness progression is rapid and wider, CABG is the preferred choice of therapy, especially for those with diabetes.[13] The most current revascularization recommendations advocate CABG for subgroups such as diabetics with high SYNTAX score and Multivessel Disease (MVD). However, an increased proportion of patients are at a high surgical risk due to substantial comorbidities, advanced age, and poor left ventricular ejection fraction.[14] We observed an increase in high-risk PCI (Percutaneous Coronary procedures) in our study group. Presence of severe comorbidities, diabetes mellitus and the anatomical severity of CVD should be among the key considerations when choosing the unique therapeutic procedures with a balanced treatment procedure, as suggested in the Heart Team study for both CABG and PCI revascularization techniques.[15]

In line with the findings of a research by Draznin *et al.*, our study group had a higher percentage of males in the categories of diabetes and non-diabetes.[16] We found a significant difference in

urea, salt, history of hypertension, and random blood sugar levels between the diabetic and non-diabetic groups. In comparison to the non-diabetic group, the results were higher in the diabetes group, our study aligned with the outcomes of diabetes mellitus after coronary artery bypass surgery in a study conducted at Urmia.[17]

According to our analysis, there was no significant difference between the PCI and CABG groups in terms of prior MI, CVA, cardiac surgery or COPD. However, it was found that a history of MI, CVA, and prior cardiac surgery was significant and more common in individuals with diabetes, but a history of COPD was not significant and was more common in non-diabetics. According to a research conducted by Estrada *et al.* carried out to analyse the relationship between perioperative hyperglycemia and CABG, the choice of drugs for diabetes and non-diabetes groups, it was more likely for diabetes.[18] According to the Kubal research, renal failure and diabetes are significantly correlated, which is consistent with our findings.[19] Hemoglobin, potassium, and creatinine levels were found to be insignificant in our investigation, which was consistent with the results of the earlier study, while BMI was not found to be relevant, in contrast to the study by Wahid *et al.*[20] Due to the substantial operational risk involved in cardiac surgery, the number of people with CVD and DM in high-risk cohorts is increasing and many of them typically have distinct grounds for PCI. Arrhythmia, re-exploration for bleeding, stroke after revascularization, Pulmonary Embolism (PE), perioperative mortality, neurological (strokes and ischemic attacks) within-discharge mortality, and postoperative mortality within 30 days of follow-up were all analyzed as clinical outcomes. Between the DM and non-DM cohorts, we did not discover any statistically significant differences. High-risk DM patients who had PCI did not experience a noticeably higher in-hospital MACCE rate (Major Adverse Cardiac and Cerebrovascular Events) or an obvious change in one-month survival.

### Study Limitations

The study possesses certain limitations. The investigation was conducted using a small cohort from a single tertiary care center in South India hence limiting the possibility of extrapolating results and establishing causality to overall population.

## CONCLUSION

To sum up, diabetes has little influence on adverse clinical outcomes or immediate side effects in our participants who had coronary revascularization. It was also observed that additional independent risk variables, such as urea, salt levels, and hypertension, need to be considered even though diabetes is often regarded as a major risk factor for coronary disease. To identify delayed complications in diabetic patients following revascularization, a bigger prospective randomized controlled multicenter trial with long-term follow-up data is needed.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## ABBREVIATIONS

**WHO:** World Health Organization; **CABG:** Coronary Artery Bypass Graft; **PCI:** Percutaneous Coronary Intervention; **eGFR:** Estimated Glomerular Filtration; **BMI:** Body Mass Index; **COPD:** Chronic obstructive pulmonary disease; **CVA:** Cerebrovascular accident; **DES:** Drug Eluting Stents; **TVD:** Triple Vessel Disease; **SVD:** Single Vessel Disease; **DVD:** Double Vessel Disease.

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