

Relation of HbA1c Control in Diabetic Patients and Complications of Percutaneous Coronary Intervention in Patients who performed Coronary Artery Bypass Graft

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ABSTRACT

Background: Coronary artery disease is higher in risk with diabetes mellitus, and diabetes-related deaths can lead to ischemic heart disease. We examined the relationship between the glycemic regulation as determined by Hemoglobin A1c and the occurrence of periprocedural complications in patients who performed percutaneous coronary intervention (PCI) and had Coronary artery Bypass Graft (CABG)

Objective: To identify associated complications and their sites with Percutaneous Coronary Intervention in diabetic patients who performed Coronary Artery Bypass Graft.

Methods: The cross-sectional analysis was performed at the cardiology department in Zagazig University Hospital in which all 24 CABG & DM patients were included during the period between January 2019 and January 2020 divided into 12 patients with controlled DM (HbA1c <7) & 12 patients with uncontrolled DM (HbA1c >7). Both patients had a complete medical history, a detailed clinical evaluation, and preoperative laboratory work: role of the renal, completion of blood counts as a marker for regulation of DM, ECG, and ECHO. Glycosylated Hemoglobin HbA1c was used.

Results: There was a statistically non-significant increase in PCI of Native coronaries in group 2 compared to group 1 ($p=0.386$) and also there was a statistically non-significant increase in PCI of Vein graft in group 2 compared to group 1 ($p=0.371$) but There was a statistically non-significant increase in PCI of Arterial in group 1 compared to group 2 ($p=0.217$). There was no statistically significant difference between the two groups ($p=0.131$). Rate of failure of venous graft PCI in uncontrolled diabetes was much higher than in those with controlled diabetes (83% compared to 50% respectively).

Conclusion: Control of DM guided by HbA1c level (<7) reduces the complications during percutaneous coronary intervention in diabetic patients with a previous coronary artery bypass graft. And in these patients who need elective PCI, control of their diabetes is advised before the procedure. In cases of uncontrolled diabetes, it is preferred to use arterial Graft instead of venous Graft in Bypass Graft Procedure.

Keywords: *Diabetes mellitus, Coronary Artery Bypass Graft, percutaneous coronary intervention.*

Introduction:

Over half of all diabetic patients die of coronary disease and account for over a fifth of percutaneous coronary intervention (PCI) revascularization procedures. Despite recent therapeutic advances such as new antiplatelet treatments and drug-eluting stents, outcomes for diabetic patients after PCI is still significantly worse than for non-diabetic patients. (1).

Diabetic patients commonly undergo percutaneous revascularization procedures; 25% to 30% of all percutaneous coronary interventions (PCIs) are performed in patients with DM. A diagnosis of DM is also considered equivalent to having CAD because diabetic patients without a history of CAD have 5-year cardiovascular mortality that is similar to that of nondiabetic patients who have a history of myocardial infarction (MI)(2).

Coronary heart disease (CHD) is characterized by the development of atherosclerotic plaques: asymmetrical focal thickenings of the intima consisting of cells, connective tissue elements, lipids, and debris. The development of these plaques is often manifested by stable angina symptoms. A higher blood glucose level causes damage to various organs and is the major cause of cardiovascular diseases, which account for 65% of deaths among people with diabetes the most commonly reported complications among Thai patients with diabetes are coronary heart disease and hypertension. Diabetes management aims at glycemic control, prevention of acute and chronic complications(3).

Coronary artery bypass graft (CABG) and percutaneous coronary intervention (PCI) are alternative treatments for multivessel coronary disease. CABG might be a better option for patients with diabetes and patients aged 65 years or older(4).

In the current study, we aimed to study and clarify the sites of associated complications with Percutaneous coronary intervention and good blood sugar control in diabetic patients who have undergone Coronary Artery Graft Bypass.

Patients and Method:

In Zagazig University hospital, this comparative cross-sectional analysis included all 24 CABG and DM patients divided into 1st group 12 patients with controlled DM ($HbA1c < 7$) & 2nd group 12 patients with uncontrolled DM ($HbA1c > 7$) during the period January 2019 to January 2020.

After their written informed consent and approval from the local hospital ethics committee, patients were registered for the review.

The trial consisted of patients with optional coronary angiography, patients with CABG, patients with Type 1 or 2 DM, and patients with stable angina who did not respond to medical treatment. After being excluded. Patients with anemia or polycythemia, patients with genes such as thalassemia, patients with domestic contraindications.

All patients have received a comprehensive medical record, full clinical review, pre-operative lab work: kidney function, complete blood counts, and the marker for DM, ECG, ECHO, and Glycosylated Hemoglobin HbA1c.

Data analyses were done using version 20 of the SPSS (Statistical Social Science Package) program. The statistical analysis was carried out with the Social Sciences Version 22 Statistical

Package (IBM Corp., Armonk, NY, USA). As means and standard deviations, quantitative data are expressed.

To suggest relevance, P-Value $\leq 0,05$ was considered significant. The study of associations tests the relationship intensity of two variables.

Results:

Patients had a mean age of (61.5±7.9) with male predominance (70.8%). They had a mean BMI of (25.2±2.1), most of them had type 2 DM (75%) and on insulin treatment (58.3%), OHD (29.2%), and combined treatment (12.5%). 62.5% had HTN, 75% had dyslipidemia, 45.8% smokers, and 8.3% had chronic lung diseases. 20.8% had a family history of CAD(**Table 1**).

Patients had a mean duration of CABG (7.13±3.6) with a mean number of grafts of (2.25±0.73). Most of them had angina grade III (66.7%). 50% had dyspnea, 4.2% had orthopnea, and 8.3% had PND(**Table 2**).

Patients had a mean EF of (47.9±8.3) with (75%) had segmental wall motion abnormalities. 66.7% had ECG changes, 12.5% had MSCT coronary, 29.2% had a failure of the arterial graft, 66.7% had a failure of the venous graft, 66.7% had PCI of native, 29.2% had PCI of vein graft and 12.5% had PCI of arterial graft(**Table 3**).

Patients had a mean hospital stay of 1.46±1.29 days and 33.3% had periprocedural complications. 8.3% of patients had failed PCI, 16.7% had dissection, and 4.2% had no-reflow, perforation, cardiac tamponade, cardiogenic shock, acute heart failure, and sudden arrest. No death occurred(**Table 4**).

There was a statistically non-significant increase in failure of Arterial graft in group 1 compared to group 2 (p=0.371). There was a statistically non-significant increase in failure of Venous graft in group 2 compared to group 1 (p=0.083). There was a statistically non-significant increase in PCI of Native coronaries in group 2 compared to group 1 (p=0.386). There was a statistically non-significant increase in PCI of Vein graft in group 2 compared to group 1 (p=0.371). There was a statistically non-significant increase in PCI of Arterial in group 1 compared to group 2 (p=0.217).Rate of failure of venous graft PCI in uncontrolled diabetes was much higher than in those with controlled diabetes (83% compared to 50% respectively)(**Table 5**).

Table (1): Patients' demographic characteristics.

Characteristics	(N=24)
Age _{years}	61.5±7.9 (45-76)
Gender	
Male	17(70.8%)
Female	7(29.2%)
BMI _{kg/m²}	25.2±2.1 (23-30)
D.M	
Type 1	6(25%)
Type 2	18(75%)
Duration of DM	18.13±9 (3-40)

Treatment	
Insulin	14(58.3%)
Oral hypoglycemic	7(29.2%)
Combined	3(12.5%)
Status	
Controlled	12(50%)
Not controlled	12(50%)
Major cardiovascular risk factors :	
Hypertension	15(62.5%)
Dyslipidemia	18(75%)
Smoking	11(45.8%)
Chronic lung diseases	2(8.3%)
Family history of CAD	5(20.8%)

BMI: body mass index, DM: diabetes mellitus, CAD: coronary artery disease

Table (2): Patients' clinical characteristics

Characteristics	(N=24)
Duration of CABG	7.13±3.6 (1-15)
Number of grafts	2.25±0.73 (1-3)
Angina grades	
II	5(20.8%)
III	16(66.7%)
IV	3(12.5%)
Dyspnea	12(50%)
Orthopnea	1(4.2%)
PND	2(8.3%)

CABG: coronary artery bypass graft, PND: paroxysmal nocturnal dyspnea

Table (3): Patients' ECG and Echo characteristics.

Characteristics	(N=24)
EF	47.9±8.3 (35-65)
SWMA	18(75%)
ECG changes	16(66.7%)
MSCT coronary	3(12.5%)
failure of arterial graft	7(29.2%)
failure of venous graft	16(66.7%)

PCI of Native	16(66.7%)
PCI of vein graft	7(29.2%)
PCI of Arterial graft	3(12.5%)

EF: ejection fraction, SWMA: segmental wall motion abnormalities, ECG: electrocardiogram, MSCT: multislice computer tomography, PCI: percutaneous coronary intervention

Table (4): Periprocedural complications.

Characteristics	(N=24)
Hospital stay(days)	1.46±1.29 (1-7)
Periprocedural complications	8(33.3%)
Failed PCI	2(8.3%)
Dissection	4(16.7%)
No reflow	1(4.2%)
Perforation	1(4.2%)
Cardiac tamponade	1(4.2%)
Cardiogenic shock	1(4.2%)
Acute heart failure	1(4.2%)
Sudden arrest	1(4.2%)
Death	0(0%)

Figure 1:periprocedural complication

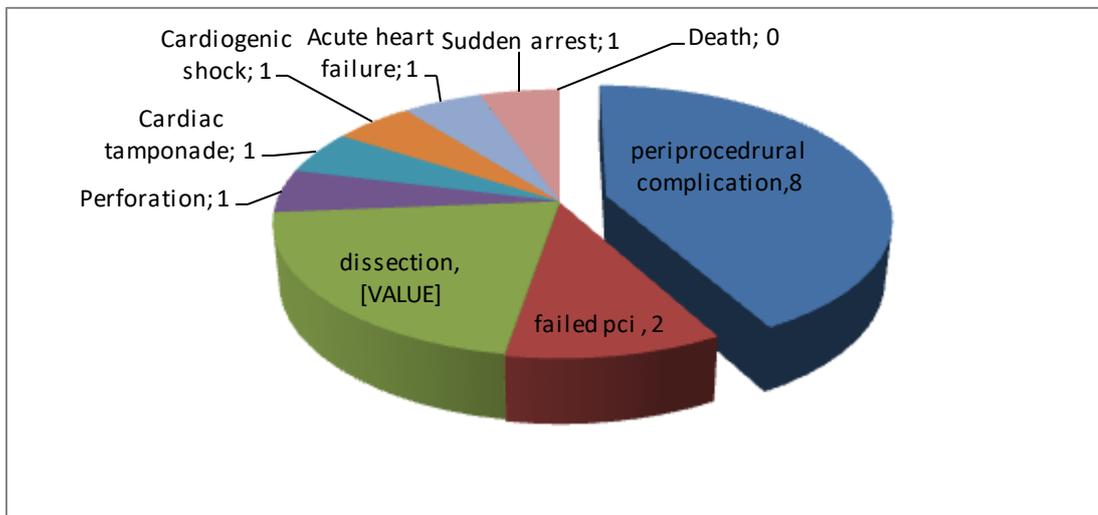


Table (5): Relation of complication to PCI in both groups.

Characteristics	Group 1 (N=12)	Group 2 (N=12)	P-value
Failure of arterial graft	5(41.7%)	2(16.7%)	0.371 ²
Failure of venous graft	6(50%)	10(83.3%)	0.083 ³
PCI of Native coronaries	7(58.3%)	9(75%)	0.386 ²
PCI of vein graft	2(16.7%)	5(41.7%)	0.371 ³
PCI of Arterial graft	3(12.5%)	0(0%)	0.217 ³

Discussion:

Approximately half of the patients' candidates for coronary artery bypass graft surgery (CABG surgery) have diabetes mellitus or metabolic syndrome. Diabetic patients are characterized by more diffuse coronary artery disease, abnormal fibrinolysis, impaired platelet function, abnormal endothelial function with more expectation of lower graft patency, and increased perioperative mortality. Postoperative hyperglycemia was considered as a predictor of poor outcomes post-CABG surgery (5). Uncontrolled hyperglycemia can predispose to increased incidence of ischemic brain injury, arrhythmia, and sternal wound infection due to impaired phagocytosis and neutrophilic function in diabetic patients(6).

However, the relationship between blood glucose levels at the time of the PCI option and the 30-day outcomes from that procedure is poorly evaluated. Since it is not clear that heart event was more sensitive than eugenics to hyperglycemia or hypoglycemia, we aimed to investigate the relationship between blood glucose pre-procedural levels and myocardial injury in PCI-patients. This research was therefore aimed to evaluate the impact of DM control on PCI outcomes in CABG patients.

Patients with male predominance in our sample were of mean age (61.5±7.9) (70.8 percent). It had an average BMI of (25.2±2.1), most had type 2 DM (75%) and insulin (58.3%), OHD (29.2%), and care combined (12.5 percent). 62.5% had HTN, 75% dyslipidemia, 45.8% smoking, and 8.3% chronic pulmonary disease. The family history of CAD is 20.8 percent.

Our results agreed in this concern with **Madani et al.'s (7)** study, patients with a male prevalence of pre-operative hyperglycemia and hypertension and hyperlipidemia were unlikely to be smokers and to have a family history of CAD. Besides, the age of the glycemic group was negligible.

Other authors have previously published similar findings. In contrast between diabetic and non-diabetic patients, procedural complications were observed despite substantial variations of median, sexual and other comorbidities(8).

In our study, there was a statistically non-significant increase in PCI of Native coronaries in group 2 compared to group 1, also there was a statistically non-significant increase in PCI of Vein graft in group 2 compared to group 1, but There was a statistically non-significant increase in PCI of Arterial in group 1 compared to group 2.

In **Januszek et.al (9)** study there was an increase in complication rate in the SVG group in comparison to non-IMA/SVG group. Although there was no significant difference between PCI to IMA and non-IMA/SVG groups, the SVG group had a higher significant difference in overall complication rate than the IMA group.

However, in **Kinnaird et al.(10)** study, while tamponade still occurred in >10% of the population without a significant difference between the graft and native vessel PCI.

Conclusion

In the diabetic patients with previous coronaryartery bypass graft, we concluded the DM regulation of HbA1c level (<7), which decreases their complications. Regulation of their diabetes is recommended before the procedure for these patients who need PCI electives.In cases of uncontrolled diabetes, it is preferred to use arterial Graft instead of venous Graft in Bypass Graft Procedure.

Conflict of Interest: No conflict of interest.

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