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Periprocedural Complications of Percutaneous Coronary Intervention in Diabetic Patients Who Underwent Coronary Artery Bypass Graft

Mohamed Gaber Abd El Aziz Abd El Hamed[1],AlySaad [2],Tamer Mohamed Mostafa[3], Marwa Mohamed Gad [4]

[1] Cardiology resident, Suez Health Insurance Hospital, Suez, Egypt

[2] Professor of cardiology, Zagazig University, Sharkia, Egypt.

[3] Professor of cardiology, Zagazig University, Sharkia, Egypt.

[4] Assistant professor of cardiology, Zagazig University, Sharkia, Egypt

Corresponding author:Mohamed Gaber Abd El Aziz Abd El Hamed

Email: Mohamed.Gaber1112526@gmail.com

ABSTRACT

Background:There is an increase of risk of coronary artery disease about 4-fold with diabetes mellitus, and ischemic heart disease is liable for diabetes-related deaths. In this study, we examined the association between glycemic control, as determined by Hemoglobin A1c, and the incidence of periprocedural complications in diabetic patients who had coronary artery bypass graft (CABG) undergoing percutaneous coronary intervention (PCI).

Aim of the study:To assess the effect of control of DM on the outcome of PCI in patients who underwent CABG.

Methods:This comparative cross-sectional study was conducted at the department of cardiology in Zagazig university hospital included all 24 patients with CABG & DM during the period from January 2019 to January 2020 divided into controlled DM (HbA1c<7)&12 patients with uncontrolled DM (HbA1c>7)comparative control group. All patients were subjected to full medical history, complete clinical examination, Pre-operative Laboratory Workup: Kidney function, Complete blood counts, and Glycosylated Hemoglobin HbA1c as a marker for control of DM, ECG, and ECHO.

Results:There was no statistically significant difference between both groups in-hospital stay (p= 0.131), but there was a statistically higher significant increase in periprocedural complications in uncontrolled DM compared to controlled DM. There was a statistically significant negative correlation between control of DM and periprocedural complications in both groups (p=0.028).

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.

Keywords: Percutaneous Coronary Intervention, Diabetes Mellitus, Coronary Artery Bypass Graft.

Introduction:

Diabetic patients are susceptible to a diffuse progressive form of atherosclerosis, which requires revascularization. In the United States, about one-third of all percutaneous coronary intervention (PCI) procedures are done on diabetic patients**(1)**.

Although the progress in revascularization strategies, ischemic heart disease accounts for about three quarter of all hospital admissions and 80% of mortality in patients with diabetes. Despite using drug-eluting stents has decreased the restenosis percentage and clinical events after percutaneous coronary intervention (PCI), later the diabetes mellitus has been verified to be a very potent risk factor for in-stent restenosis **(2)**.

The number of diabetic patients who need revascularization for coronary artery disease will increase with advanced diabetes mellitus **(3).**

In the study done before at Kansas City, Missouri, and Royal Oak, Michigan, there is a significantly higher rate of ischemic heart disease, frequent rehospitalization, and recurrent angina in uncontrolled diabetic patients. Moreover, well-controlled diabetic patients had rates of adverse clinical events comparable to those of non-diabetic patients. These data suggest that good control of diabetes with HA1c levels <7% may be useful in decreasing restenosis rate and improve the clinical outcome after PCI**(4).**

Chronic coronary syndrome, including recurrent angina after coronary artery bypass grafting (CABG), has been broadly treated by the percutaneous coronary intervention (PCI) to reduce clinical symptoms and death.CABG might be a better option for patients with diabetes and patients aged 65 years or older**(5).**

In this study, we examined the association between glycaemic control, as determined by Haemoglobin A1c, and the incidence of periprocedural complications in diabetic patients who had coronary artery bypass graft (CABG) undergoing percutaneous coronary intervention (PCI).

Patients and Method:

This comparative cross-sectional study was conducted at the department of cardiology in Zagazig university hospital included all 24 patients with CABG & DM during the period from January 2019 to January 2020 divided to: into 12 patients with controlled DM (HbA1c<7)&12 patients with uncontrolled DM (HbA1c>7).

Patients were enrolled in the study after obtaining their written informed consent, and approval of the local ethics committee of the hospital.

Patients included in the study who had been scheduled for elective coronary angiography, patients who had CABG, patients who had DM either type1 or type 2, and patients who had stable angina unresponsive to medical treatment.

After exclusion of. patients who had anemia or polycythemia,patients who had a genetic condition such as thalassemia, Patientswho had contraindications to dye as dye allergy.

All patients were subjected to full medical history, complete clinical examination, Pre-operative Laboratory Workup: Kidney function, Complete blood counts, and Glycosylated Hemoglobin HbA1c as markers for control of DM, ECG, and ECHO.

Data analysis was performed using the software SPSS (Statistical Package for the Social Sciences) version 20. Statistical analysis was performed using Statistical Package for The Social Sciences Version 22 (IBM Corp., Armonk, NY, USA). Quantitative data are expressed as means and standard deviations.

P-Value ≤ 0.05 was considered to indicate significance. Correlation analysis assesses the strength of association between two variables. Multiple logistic regression analysis was used to detect the associations between lipid profile and both maternal and neonatal complications.

Results:

There were no statistically significant differences in age, BMI, gender, Type 1 DM in group 2 compared to group 1, Type 2 DM in group 1 compared to group 2, and increase in Duration of DM in group 2 compared to group 1in both groups, therewas a statistically higher significant increase in Treatment of patients on insulin in group 2 compared to group 1.There was a statistically higher significant increase in family history in group 2 compared to group 1 (**Table 1).** There was a statistically non-significant decrease in EF in group 2 compared to group 1 (p=0.131). There wasa statistically higher significant increase in Segmental wall motion abnormalities in group 1 compared to group 2 (p=0.014) There wasa statistically non-significant increase in ECG changes in group 2 compared to group 1 (p=0.386) **(Table 2).**

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) **(Table 2).**

There was no statistically significant difference between both groups in-hospital stay (p= 0.131).

There was a statistically higher significant increase in periprocedural complications in group 2 compared to group 1 (p<0.001). There was a statistically non-significant increase in failed PCI in group 2 compared to group 1 (p=0.056). There was a statistically higher significant increase in Dissection in group 2 compared to group 1 (p=0.028).There were no statistically significant differences in No reflow and Death in both groups (p=1.00). There wasa statistically non-significant increase in Perforation, Cardiac tamponade, Cardiogenic shock, Acute heart failure, and Sudden arrest in group 2 than group 1 (p=1.00) (**Table 3).**

There was a statistically significant negative correlation between control of DM and periprocedural complications in both groups (p=0.028)**(Table 4).**

Table (1): Patients' demographic characteristics in both groups.

Characteristics	**Group 1 (N=12)**	**Group 2 (N=12)**	**P-value**
Age	62.8±6.9	60.3±9.2	0.45[1]
Gender			
Male	8(66.7%)	9(75%)	1.00[2]
Female	4(33.3%)	3(25%)	
BMI $_{kg/m^2}$	25.4±2.3	25±2	0.64[1]
D.M			
Type 1	1(8.3%)	5(41.7%)	0.155[2]
Type 2	11(91.7%)	7(58.3%)	
Duration of DM	14.8±10.8	21.4±5.5	0.073[1]
Treatment			

Insulin Oral hypoglycemic Combined	4(33.3%) 6(50%) 2(16.7%)	10(83.4%) 1(8.3%) 1(8.3%)	**0.041*[2]**
Major cardiovascular risk factors: Hypertension Dyslipidemia Smoking Chronic lung diseases	 7 (58.3%) 8(66.7%) 4(33.3%) 1(8.3%)	 8(66.7%) 10(83.4%) 7(58.3%) 1(8.3%)	 0.414[2]
Family history of CAD	0(0%)	5(41.7%)	**0.037*[2]**

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

Table (2): Patients' ECG and Echo characteristics in both groups

Characteristics	Group 1 (N=12)	Group 2 (N=12)	P-value
EF	50.5±8.4	45.3±7.7	0.131[1]
SWMA	12(100%)	6(50%)	**0.014*[2]**
ECG changes	7(58.3%)	9(75%)	0.386[2]

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

Table (3): periprocedural complications in both groups.

Characteristics	Group 1 (N=12)	Group 2 (N=12)	P-value
Hospital stay$_{(days)}$	1.46±1.29	1.46±1.29	0.131[1]
Periprocedural complications	2(16.7%)	12(100%)	**<0.001*[2]**
Failed PCI	1(8.3%)	2(16.8%)	0.056[2]
Dissection	0(0%)	4(33.4%)	**0.028*[2]**
No reflow	1(8.3%)	1(8.3%)	1.00[2]
Perforation	0(0%)	1(8.3%)	1.00[2]
Cardiac tamponade	0(0%)	1(8.3%)	1.00[2]
Cardiogenic shock	0(0%)	1(8.3%)	1.00[2]
Acute heart failure	0(0%)	1(8.3%)	1.00[2]
Sudden arrest	0(0%)	1(8.3%)	1.00[2]
Death	0(0%)	0(0%)	1.00[2]

Table (4): Correlation between control of DM and periprocedural complications.

			control
	periprocedural complication	Correlation Coefficient	-.447*
		Sig. (2-tailed)	**.028**

Discussion:

Several studies have revealed that elevated blood glucose level is common in diabetic and non-diabetic patients who are a candidate for CABG and has a significant mortality rate and poor outcome. For patients candidate for primary PCI who underwent CABG, diabetes mellitus has an independent relationship with myocardial hypoperfusion, advanced cardiac diseases, and increase mortality rate **(6).**

Nonetheless, there is a paucity of multivariate analysis of the relationship between blood glucose levels at the time of elective PCI and the 30-day results of that procedure. Because it is not clear whether cardiac events are more likely to be associated with hyperglycemia or hypoglycemia than with euglycemia, we set out to evaluate the relationship between preprocedural blood glucose levels and myocardial injury in patients who have undergone PCI.So the current study aimed to assess the effect of control of DM on the outcome of PCI in patients who underwent CABG.

In our study, 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 (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.

In agreement with **Madani et al. (7)** study in which patients with preprocedural hyperglycemia were of male predominance and to have hypertension and hyperlipidemia but unlikely to be smokers and to have a family history of CAD. Moreover, there was an insignificant difference in age within the glycemic group.

Similar results have been published previously by other authors. Despite observable differences in the mean age, sex, and other comorbidities, procedural complications were in comparison between diabetic and non-diabetic patients**(8).**

Also, we found that there was a statistically non-significant increase in Hypertension, dyslipidemia,smoking, and chronic lung disease in group 2 than group 1, but There was a statistically higher significant increase in family history in group 2 compared to group 1.

Numerous studies have revealed that hypertension is a common diabetic comorbidity, affecting about 20% to 60% of diabetic patients**(9).**

Triglyceridemia in diabetic patients is associated with increased concentrations of small, dense, low-density-lipoprotein particles and a decrease of high-densitylipoprotein cholesterol**(10)**

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Our study showed that there was no statistically significant difference between both groups in-hospital stay, but there was a statistically higher significant increase in periprocedural complications in uncontrolled diabetic patients compared to controlled diabetic patients.

There are higher periprocedural complications rate and bad angiographic efficacy in diabetic patients with coronary artery calcification which result in failed PCI, higher rate of dissections, perforations, no-reflows, cardiac arrests, and deaths**(12)**.

In our study,There was a statistically non-significant increase in failed PCI in group 2 compared to group 1,but there was a statistically higher significant increase in Dissection in group 2 compared to group 1 (p=0.028),and there were statistically non-significant in No reflow and Death in both groups (p=1.00),also there wasa statistically non-significant increase in Perforation, Cardiac tamponade, Cardiogenic shock, Acute heart failure and Sudden arrest in group 2 than group 1 (p=1.00).

Similar to, Januszek et al.'s**(11)**study, the rate of successful PCI assessed as the percentage of failed PCI was significantly higher in the group of patients treated without rotational atherectomy (RA) compared to those treated with RA for diabetics and non-diabetics patients.

All clinical endpoints were significantly more likely to occur in patients experiencing a coronary perforation, there was a 10-fold increase in in-hospital mortality.

Kinnaird et al.(12) study revealed an overall incidence of coronary perforation in patients undergoing PCI with prior CABG surgery of 0.52%, a rate higher than observed in a more general PCI population.

So The main finding of the current study is that there was a statistically significant negative correlation between control of DM and periprocedural complications in both groups.

Conclusion

We concluded that 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 require elective PCI, control of their diabetes is advised before the procedure.

Conflict of Interest: No conflict of interest.

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