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# Is Diabetes Mellitus Associated with Greater Ejection Fraction Improvement After Bypass-Surgery?

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**Abstract:** ***Diabetes mellitus (DM) is associated with an important risk of coronary artery disease and is known to be related with a greater risk of cardiac mortality since the Framingham studies. Diabetic patients have characteristics that differentiate them from the general population of ischemic patients: older age and associated cardiovascular risk factors, impossibility of revascularizing all arterial territories, and a greater progression of coronary artery disease. On the one hand, this means that the risk of death of diabetics without coronary artery disease is similar to that of non-diabetic patients with a history of acute myocardial infarction, and, on the other hand, that diabetics with coronary artery disease have a worse long-term prognosis than non-diabetics. Revascularization in diabetic patients with coronary artery disease remains a challenge in cardiology practice. Although clinical trials have reported the mid-term superiority of coronary artery bypass grafting (CABG) surgery over percutaneous coronary intervention in these patients, little is known about the long-term outcomes of CABG in diabetic patients compared to non-diabetics.***

**Keywords:** Diabetes, Coronary artery bypass graft surgery, Major adverse cardiac and cerebrovascular events, acute coronary syndrome, Revascularization

## 1. Introduction

Ischemic etiology is consistently reported as a risk factor for lack of ejection fraction (EF) improvement among patients with heart failure (HF) (1–3). Revascularization including coronary artery bypass grafting (CABG) (4) and percutaneous coronary intervention (PCI) (5–7) may improve long-term outcome by attenuating the ischemic state and reversing left ventricular (LV) remodeling for patients with ischemic HF (8–10). However, the extent and determinants of EF improvement have not been well-investigated (9, 11–14).The presence of myocardial viability has been shown to be predictive of EF improvement after coronary revascularization (11, 15, 16). However, not all patients with viable myocardium show an improvement of EF. In different studies, about 12% (16) to 64% (11) patients remained EF unimproved after revascularization. Besides myocardial viability, patients with more extensive coronary artery disease (CAD) and worse myocardial dysfunction and remodeling may receive greater benefit from revascularization (17).Diabetic patients are associated with the decreased utilization of glucose and the increase in myocardial free fatty acids, occurring as a consequence of the mismatch between blood supply and cardiac metabolic requirements (18). These metabolic changes are responsible both for the increased susceptibility of the diabetic heart to myocardial ischemia and for a greater decrease of myocardial performance for a given amount of ischemia, compared to non-diabetic hearts. However, the association between diabetic status and EF improvement following revascularization has not been addressed. We hypothesize that in diabetic patients with LV dysfunction, the effects of revascularization could even give greater benefit than in non-diabetic patients. The aim of the study was to evaluate if in diabetics the cardiac function improves more post bypass compared to those without diabetes.

## 2. Material and Methods

This is a prospective study conducted at American Hospital No 3 in Tirana, Albania. A total of 543 patients who underwent selected and isolated OPCAB from March 1, 2017 to December 30, 2020 were selected for this study. The excluded criteria, included history of AF, non-sinus rhythm, congenital heart disease, concomitant surgery, valvular heart disease, cardiac pacemaker implantation. Patients were divided into AF group and non-AF group according to whether they had new-onset AF after OPCAB. AF was denied as any episode of AF noted by continuous ECG/telemetry monitoring, or documented by a physician in the chart, lasting for 30 s or more. The present study includes multiple pre, intra, and post OPCAB variables. The laboratory and ultrasound data are the values of the check before surgery. Perioperative medicine history and in-hospital complications were recorded carefully. In our study, two researcher's collected clinical data, and the data between them had a high consistency. All patients were admitted into ICU after surgery and underwent continuous hardwire monitoring of blood pressure, pulse, electrocardiogram. After the patient leaved the ICU, continuous telemetry monitoring of blood pressure, pulse, electrocardiogram would be performed until discharge. Patients were checked for blood tests, liver and kidney function immediately and daily after surgery. If the patient did not have any contraindications, nitroglycerin, β-blocker, and antiplatelet drugs were routinely given after the operation. No other prophylactic therapies were taken to prevent postoperative arrhythmia. Other drugs were given according to the patient's condition. If ECG monitoring showed that AF occurred, a 12-lead ECG and blood gas examination would be performed at the same time. And the patient would be given oral or intravenous amiodarone. All patients were converted into sinus rhythm before discharging. No patients required electrical cardioversion.

## 3. Statistical analysis

The SPSS 25.0 statistical software was uses for data analysis. Kolmogorov-Smirnov test was used to test the normality of distribution of continuous variables. Means and standard deviations were reported. Chi square test was used to compare the proportion of categorical variables. Multivariate logistic regression was used to determine the independent predictors of atrial fibrillation. A p value ≤0.05 was considered statistically significant.

## 4. Results and Discussion

Eighty-nine (16.4%) were females and 454 (83.6%) males.

Table 1 shows the mean values of EF among diabetics and non diabetics. From the data we see that there is no statistical difference post bypass which means that cardiac function did not improve more in diabetic patients.

Table 2 shows the mean values of WM index among diabetics and non diabetics. Likewise, from the data we see that there is no statistical difference post bypass which means that cardiac function did not improve more in diabetic patients.

In the last couple of decades, the incidence, guidelines and treatments, and subsequently mortality and comorbidities of diabetes, have been relatively changed (19, 20). Moreover, the outcomes of CABG could have been influenced by various factors throughout the years, such as the administration of the left internal mammary artery (LIMA) versus Saphenous vein graft (SVG) or other grafts as the conduit (21, 22). Also, the growing tendency to undergo medical treatment or intervention instead of surgery led to a drop in surgical trends even among the indicated patients for CABG (23). For instance, although, according to a study in the united states, the post-operative mortality of CABG has remained unchanged over the years, the patients undergoing surgery have become older and with more comorbid conditions such as diabetes (24). Diabetes has been associated with higher post-surgery mortality, especially in patients more aged than 80 years old (25,26).This trend has to be studied in developing countries, too. Considering all of these trends, the evaluation of how they have affected the CABG outcomes in diabetic patients, whether the survival is still worse, and how much the incidence of adverse long-term outcomes is higher in patients with diabetes compared to the non-diabetic patients are among the most critical issues that should be addressed. The increasing number of diabetic patients undergoing CABG necessitates studies like ours, which evaluate the short-term or long-term outcomes in this group of patients.

## 5. Conclusion

Since diabetic patients constitute a major and demanding proportion of the patient's undergoing CABG, evaluating the outcomes and proposing solutions to improve these outcomes are mandatory. Additionally, diabetes is a condition accompanied by chronic inflammation and macro- and microvascular dysfunction. Some of the most significant complications of it, such as chronic kidney disease and myocardial infarction, would not appear until after a long course of time. Hence, the follow-up and investigation of the long-term post-operative outcomes in a large group of patients would be worth evaluation.

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**Table 1:** Comparison of the mean values of EF among diabetics and non diabetics

| Ejection fraction | DM, NO | | DM, Yes | | P |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| EF | 49.754 | 6.7801 | 49.45 | 7.67 | 0.6 |
| Ef post I | 49.427 | 7.1256 | 49 | 7.7151 | 0.5 |
| EF post2- 1months | 50.771 | 6.257 | 50.372 | 6.7835 | 0.5 |
| EF post 3 -3 months | 51.857 | 5.8238 | 51.782 | 6.6152 | 0.8 |
| EF post 4-6months | 53.565 | 5.2551 | 53.645 | 6.0322 | 0.8 |

**Table 2:** Comparison of the mean values of WM index among diabetics and non diabetics

| WM index | DM, NO | | DM, Yes | | P |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| WM index pop. | 1.283 | 0.2791 | 1.321 | 0.3121 | 0.1 |
| WMSI post 1 month | 1.303 | 0.3044 | 1.335 | 0.3463 | 0.3 |
| WMSI post 2- 1months | 1.298 | 0.6927 | 1.918 | 8.1575 | 0.2 |
| WMSI post 3-3months | 1.21 | 0.1924 | 2.166 | 11.305 | 0.2 |
| WM post 4- 6 months | 1.143 | 0.1589 | 1.161 | 0.1967 | 0.3 |