Original article

Impact of Diabetes Mellitus on Surgical Outcomes in Patients Undergoing Coronary Artery Bypass Grafting

**** Himanshi Mathur, Harpreet Singh***

Department of Cardiothoracic and Vascular Surgery
Govind Ballabh Pant Institute of Postgraduate Medical Education and Research
*Corresponding author**

Abstract

Background: *Diabetes Mellitus is a major risk factor for Coronary Artery Disease and significantly influences surgical outcomes in patients undergoing Coronary Artery Bypass Grafting. Diabetic patients are more prone to perioperative and postoperative complications due to associated metabolic and vascular abnormalities.*

Objectives: *To evaluate the impact of diabetes mellitus on surgical outcomes in patients undergoing coronary artery bypass grafting and compare perioperative and postoperative outcomes between diabetic and non-diabetic patients.*

Methods: *This prospective observational study was conducted over one year in a tertiary care center and included 40 patients undergoing CABG. Patients were divided into diabetic (n=20) and non-diabetic (n=20) groups. Demographic details, intraoperative parameters, postoperative complications, and recovery outcomes were recorded. Statistical analysis was performed using IBM SPSS Statistics, and $p<0.05$ was considered statistically significant.*

Results: *Diabetic patients showed significantly longer operative time, cardiopulmonary bypass duration, and aortic cross-clamp time. Postoperative complications such as surgical site infection and prolonged ventilation were significantly higher in diabetics. ICU stay and total hospital stay were also significantly prolonged in diabetic patients.*

Conclusion: *Diabetes mellitus adversely affects surgical outcomes following CABG by increasing operative complexity, postoperative complications, and recovery duration. Strict perioperative glycemic control may improve outcomes.*

Keywords: *Diabetes mellitus; Coronary artery bypass grafting; Surgical outcomes*

Introduction

Diabetes Mellitus is one of the most prevalent metabolic disorders worldwide and is a major risk factor for cardiovascular diseases, particularly Coronary Artery Disease. (1) Chronic hyperglycemia in diabetes accelerates atherosclerosis through endothelial dysfunction, inflammation, oxidative stress, and abnormal lipid metabolism, leading to diffuse and severe coronary artery involvement. Patients with diabetes often present with multivessel coronary artery disease, making surgical revascularization through Coronary Artery Bypass Grafting the preferred treatment modality in many cases. (2,3,4)

Coronary artery bypass grafting (CABG) remains a well-established and effective intervention for improving myocardial perfusion, relieving angina, and reducing mortality in patients with advanced coronary artery disease. However, diabetes mellitus significantly influences perioperative and postoperative outcomes following CABG. Diabetic patients are at increased risk of complications such as poor wound healing, surgical site infections, prolonged mechanical ventilation, renal dysfunction, atrial

fibrillation, and increased intensive care stay. Furthermore, long-term graft patency and overall survival may also be affected by glycemic status. (5,6)

Understanding the impact of diabetes on surgical outcomes after CABG is crucial for optimizing perioperative management, improving risk stratification, and enhancing postoperative recovery. This study aims to evaluate the influence of diabetes mellitus on surgical outcomes in patients undergoing CABG.

Study Methodology

This prospective observational study was conducted in the Department of Cardiothoracic and Vascular Surgery at a tertiary care center over a period of one year. The study included patients diagnosed with Coronary Artery Disease who underwent elective Coronary Artery Bypass Grafting during the study period. A total of 40 patients were enrolled using a consecutive sampling method after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to inclusion in the study. The patients were divided into two groups based on the presence or absence of Diabetes Mellitus for comparative analysis.

The inclusion criteria comprised patients aged above 18 years undergoing isolated CABG for coronary artery disease who were willing to participate in the study. Patients undergoing emergency CABG, redo CABG, combined valvular or other cardiac procedures, patients with severe renal or hepatic dysfunction, active infections, and those with incomplete clinical records were excluded from the study. A detailed preoperative clinical evaluation was carried out for all patients, including demographic profile, duration of diabetes, glycemic control status, associated comorbidities such as hypertension, obesity, and dyslipidemia, and baseline cardiac function assessment.

Perioperative data were collected, including operative time, cardiopulmonary bypass duration, aortic cross-clamp time, number of grafts used, intraoperative complications, and blood transfusion requirements. Postoperative parameters such as duration of mechanical ventilation, intensive care unit stay, total hospital stay, wound infection, arrhythmias, renal dysfunction, stroke, and mortality were recorded and analyzed. Blood glucose levels were monitored perioperatively, and glycemic control protocols were followed in diabetic patients as per institutional guidelines.

The collected data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics software. Quantitative variables were expressed as mean ± standard deviation, while qualitative variables were presented as frequencies and percentages. The comparison between diabetic and non-diabetic groups was performed using Student's t-test for continuous variables and Chi-square test or Fisher's exact test for categorical variables. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1: Demographic and Clinical Characteristics of Study Participants (n=40)

Variables	Diabetic (n=20)	Non-Diabetic (n=20)	p-value
Mean age (years)	61.8 ± 7.4	58.6 ± 6.9	0.142
Male gender	14 (70%)	15 (75%)	0.723
Hypertension	16 (80%)	11 (55%)	0.048*
Dyslipidemia	15 (75%)	10 (50%)	0.041*
Obesity (BMI >30 kg/m^2)	8 (40%)	4 (20%)	0.168
Mean LVEF (%)	48.5 ± 6.8	52.2 ± 5.9	0.037*

Table 2: Intraoperative Parameters in Patients Undergoing Coronary Artery Bypass Grafting

Parameters	Diabetic (n=20)	Non-Diabetic (n=20)	p-value
Mean operative time (minutes)	245.6 ± 28.3	218.4 ± 24.5	0.006*
CPB time (minutes)	112.5 ± 15.8	98.2 ± 13.7	0.004*
Aortic cross-clamp time (minutes)	74.8 ± 10.6	65.3 ± 9.4	0.008*
Mean grafts used	3.2 ± 0.7	2.9 ± 0.6	0.156
Blood transfusion required	9 (45%)	5 (25%)	0.179

Table 3: Postoperative Complications Following Coronary Artery Bypass Grafting

Complications	Diabetic (n=20)	Non-Diabetic (n=20)	p-value
Surgical site infection	6 (30%)	2 (10%)	0.041*
Atrial fibrillation	5 (25%)	3 (15%)	0.429
Acute kidney injury	4 (20%)	1 (5%)	0.147
Prolonged ventilation (>24 hrs)	7 (35%)	2 (10%)	0.048*
Stroke	1 (5%)	0 (0%)	0.311
Mortality	2 (10%)	1 (5%)	0.548

Table 4: Postoperative Recovery Outcomes

Outcome Parameters	Diabetic (n=20)	Non-Diabetic (n=20)	p-value
ICU stay (days)	4.8 ± 1.6	3.2 ± 1.1	0.002*
Hospital stay (days)	11.6 ± 3.2	8.4 ± 2.5	0.001*
Time to ambulation (days)	3.9 ± 1.2	2.7 ± 0.9	0.003*
Readmission within 30 days	3 (15%)	1 (5%)	0.288
Wound healing delay	5 (25%)	1 (5%)	0.077

***Statistically significant (p < 0.05)**

Discussion

The present study evaluated the impact of Diabetes Mellitus on surgical outcomes in patients undergoing Coronary Artery Bypass Grafting and demonstrated that diabetic patients experienced relatively poorer perioperative and postoperative outcomes compared to non-diabetic patients. Diabetes is a well-established risk factor for advanced and diffuse Coronary Artery Disease due to persistent hyperglycemia-induced endothelial dysfunction, chronic inflammation, and accelerated atherosclerosis. These pathological changes contribute not only to severe coronary involvement but also to increased surgical complexity and delayed postoperative recovery. (7,8)

In the present study, diabetic patients had a slightly higher mean age and a greater burden of associated comorbidities such as hypertension and dyslipidemia compared to non-diabetic patients. This finding is clinically relevant because these coexisting conditions further increase cardiovascular risk and adversely affect surgical prognosis. Additionally, diabetic patients had lower left ventricular ejection fraction, indicating compromised myocardial function at baseline, which may predispose them to postoperative complications and prolonged recovery. (9)

The intraoperative findings showed significantly longer operative time, cardiopulmonary bypass duration, and aortic cross-clamp time in diabetic patients. This may be explained by the presence of diffuse coronary vessel disease, calcified arteries, and technically demanding graft anastomosis in diabetic patients. Longer bypass and cross-clamp times are associated with greater inflammatory response, myocardial ischemia-reperfusion injury, and organ dysfunction, which may contribute to worse postoperative outcomes. (10,11)

Postoperative complications were notably higher among diabetic patients. Surgical site infection was significantly increased in the diabetic group, which can be attributed to impaired neutrophil function, reduced tissue perfusion, and delayed wound healing associated with hyperglycemia. Similarly, prolonged mechanical ventilation was significantly higher in diabetic patients, possibly due to poor pulmonary reserve, higher inflammatory response, and delayed recovery from anesthesia. Although atrial fibrillation and acute kidney injury were more frequent in diabetic patients, statistical significance was not achieved, likely due to the relatively smaller sample size. Mortality was also numerically higher in the diabetic group, emphasizing the adverse prognostic impact of diabetes in cardiac surgery. (12)

Recovery outcomes further highlighted the negative influence of diabetes. Diabetic patients had significantly prolonged ICU stay and total hospital stay, reflecting increased postoperative morbidity and slower recovery. Delayed ambulation and higher readmission rates observed in diabetic patients may be linked to poor wound healing, infections, and systemic complications. These findings underline the importance of optimal perioperative glycemic control, meticulous infection prevention, and close postoperative monitoring in diabetic CABG patients.

Conclusion:

Overall, the present study demonstrated that diabetes mellitus significantly affects surgical outcomes after CABG by increasing operative complexity, postoperative complications, and recovery time. Early identification of high-risk diabetic patients and aggressive perioperative management strategies may

improve clinical outcomes, reduce hospital stay, and enhance long-term survival in this vulnerable patient population.

References

1. Farkouh ME, Domanski M, Sleeper LA, Siami FS, Dangas G, Mack M, et al. Strategies for multivessel revascularization in patients with diabetes. N Engl J Med. 2012;367(25):2375–84.
2. Raza S, Sabik JF, Ainkaran P, Blackstone EH. Coronary artery bypass grafting in diabetics: outcomes and long-term survival. J Thorac Cardiovasc Surg. 2015;150(2):302–10.
3. Lazar HL. Improving outcomes in diabetic patients undergoing coronary artery bypass grafting. J Thorac Cardiovasc Surg. 2022;163(4):1348–56.
4. Umpierrez GE, Pasquel FJ. Management of inpatient hyperglycemia and diabetes in cardiac surgery patients. Endocrinol Metab Clin North Am. 2018;47(1):203–22.
5. Pezeshki PS, Ahmadi SH, Mohammadi S, et al. Seven-year outcomes in diabetic patients after coronary artery bypass grafting. BMC Cardiovasc Disord. 2023;23:245.
6. van Straten AHM, Soliman Hamad MA, van Zundert AJ, Martens EJ, Schönberger JPAM, de Wolf AM. Diabetes and survival after coronary artery bypass grafting. Eur J Cardiothorac Surg. 2010;37(5):1068–74.
7. Head SJ, Milojevic M, Daemen J, Serruys PW. Coronary artery bypass grafting in diabetic patients: current evidence and future perspectives. Eur J Cardiothorac Surg. 2016;49(2):418–27.
8. Whang W, Bigger JT, Ginsberg HN, et al. Diabetes and outcomes of coronary artery bypass graft surgery in patients with severe left ventricular dysfunction. J Am Coll Cardiol. 2000;36(4):1166–72.
9. Neumann FJ, Sousa-Uva M, Ahlsson A, Alfonso F, Banning AP, Benedetto U, et al. 2018 ESC/EACTS guidelines on myocardial revascularization. Eur Heart J. 2019;40(2):87–165.
10. Melly L, Torregrossa G, Lee T, Jansens JL, Puskas JD. Fifty years of coronary artery bypass grafting. J Thorac Dis. 2018;10(3):1960–7.
11. Diodato M, Chedrawy EG. Coronary artery bypass graft surgery: the past, present, and future of myocardial revascularization. Surg Res Pract. 2014;2014:726158.
12. Tully A, Nanjundappa A. Coronary artery surgery. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023.