Original Article

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Prevalence of Type II Diabetes Mellitus and Perioperative Outcomes in Patients Undergoing Cardiac Surgery with Cardiopulmonary Bypass at a Tertiary Cardiac Center in Nepal

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Abstract

Background and aim: Diabetes mellitus (DM) is a major contributor to cardiovascular morbidity and mortality worldwide. Patients with DM undergoing cardiac surgery with cardiopulmonary bypass (CPB) experience higher rates of perioperative complications. National data describing the burden of diabetes and associated outcomes among cardiac surgical patients in Nepal remain limited.

Methods: A retrospective observational study was conducted at a tertiary cardiac center in Kathmandu. Consecutive adult patients undergoing cardiac surgery with CPB between June 2022 and June 2023 were included. Demographic, clinical, and perioperative variables were collected and analyzed descriptively, including age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) physical status, glycated hemoglobin (HbA1c), type of surgery, acute kidney injury (AKI), surgical site infection (SSI), length of intensive care unit (ICU) stay, re-exploration, in-hospital mortality.

Results: Type II DM was identified in 86 of 406 patients (21.2%). %). The median age was 60.5 years in diabetic patients and 51.5 years in non-diabetic patients, and BMI distributions were descriptively analyzed for both groups. Coronary artery bypass grafting (CABG) was performed in 73 diabetic patients (84.8%). In the diabetic cohort, acute kidney injury (AKI) was observed in 32.6% (vs. 27.5% in non-diabetics), surgical site infection in 4.7% (vs. 0%), re-exploration in 17.4% (vs. 15.9%), and in-hospital mortality in 22.1% (vs. 14.1%). The median glycated hemoglobin level (HbA1c) among diabetic patients was 7.0% (IQR, 6.0–7.8).

Conclusion: This study outlines the specific clinical distribution of diabetes mellitus in this cohort. The descriptive data support establishing routine screening pathways to optimize perioperative care.

Keywords: *Acute kidney injury, Cardiopulmonary bypass, Cardiac surgery, Diabetes mellitus, Nepal*

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Introduction

Diabetes mellitus is a rapidly expanding global health problem with the most significant rise occurring in low- and middle-income countries1. Approximately 828 million adults worldwide are living with diabetes, with the highest burden and lowest treatment rates increasingly concentrated in low and middle-income countries[2]. In Nepal, non-communicable diseases account for approximately 66% of total mortality, and the estimated adult prevalence of diabetes is 8.5%[3,4]. Type II diabetes mellitus substantially increases cardiovascular risk, leading to a growing number of diabetic patients presenting for cardiac surgical interventions[5,6].

In cardiac surgery, diabetes is a well-established risk factor for multivessel coronary artery disease, perioperative mortality, acute kidney injury, and postoperative infection[7–9]. Glycemic control plays a central role in mediating these risks. Elevated preoperative HbA1c levels and increased perioperative glucose variability are independent predictors of adverse outcomes following coronary artery bypass grafting[10,11]. Although guidelines favor coronary artery bypass grafting over percutaneous coronary intervention in diabetic patients with complex coronary disease, this benefit is marred by higher perioperative morbidity[12].

Despite extensive international literature, data describing the prevalence of diabetes and its perioperative impact in Nepalese cardiac surgical populations remain scarce[13]. Limited screening, delayed diagnosis, and restricted access to specialized care may further influence observed disease burden and outcomes. Understanding the local epidemiology of diabetes in cardiac surgery is essential for perioperative planning and quality improvement initiatives.

This study aimed to determine the prevalence and perioperative outcomes of Type II diabetes mellitus among patients undergoing cardiac surgery with cardiopulmonary bypass at a tertiary cardiac center in Nepal.

Methods

Study type and study design

This was a quantitative, retrospective, observational study.

Place and duration of study

Consecutive adult patients who underwent cardiac surgery with cardiopulmonary bypass (CPB) at Shahid Gangalal National Heart Centre (SGNHC), Kathmandu, Nepal, between June 2022 and June 2023.

Sample Size and Sampling Method

Sample size was calculated using a single-population proportion formula, assuming a diabetes prevalence of 53.2% based on prior regional data[14], which reported the clinical profile of patients undergoing coronary artery bypass grafting in a similar tertiary cardiac setting, with a 95% confidence level and 5% margin of error.

The calculated sample size was 383 patients. After accounting for potential missing or incomplete records, the final target sample size ranged from 402 to 421 patients. A total of 406 patients were analyzed. Consecutive sampling of all eligible patients during the study period was performed.

Methods of data collection

Demographic, clinical, and perioperative data were retrospectively extracted from hospital medical records. Variables collected included age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) physical status, presence of type II diabetes mellitus, and preoperative glycated hemoglobin (HbA1c) levels. Surgical variables included the type of cardiac surgery performed.

Perioperative outcomes assessed were acute kidney injury (AKI)[15], surgical site infection (SSI)[16], need for re-exploration, length of intensive care unit (ICU) stay, duration of post-ICU hospital stay, and in-hospital mortality. Diabetes mellitus was defined according to the American Diabetes Association criteria[17]. AKI and SSI were identified based on documented clinical diagnoses consistent with KDIGO and CDC definitions, respectively.

Ethical Approval and Patient Consent

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Committee of the center. (Ref No: SGNHC/IRC No: 16-2025).

Inclusion and exclusion criteria

All patients aged 18 years or older who underwent cardiac surgery requiring CPB during the study period were eligible for inclusion. Patients who underwent off-pump cardiac surgery and those with incomplete medical records were excluded.

Statistical analysis and software used

Statistical analyses were performed using SPSS version 24.0. The normality of continuous variables was assessed using the Shapiro–Wilk test. Continuous variables with a non-normal distribution are presented as median with Inter-Quartile Range, while categorical variables are summarized as frequency and percentage. All comparisons between diabetic and non-diabetic patients are presented descriptively; no hypothesis testing or inferential statistical analysis was performed.

Results:

Table 1: Baseline Characteristics of The Patients

Variables	Diabetic (n=86, 21.2%)	Nondiabetic (n=320,78.8%)	Total (n=406)
Male, n (%)	69(80.2)	179(55.9)	248
Female, n (%)	17(19.8)	141(44.1)	158
Age (years), median (IQR 25% to 75%)	60.50(54-67.25)	51.50(39-60)	-
ASA physical status III, n (%)	76(88.4)	286(89.4)	362(89.2)
ASA physical status IV and above, n (%)	10(11.6)	27(8.4)	37(9.1)
BMI, kg/m², Median (IQR)	27.006(23.78-30.08)	25.77(23.44-27.68)	158

Reflecting a rising global burden that now affects approximately 828 million adults,[2] Type II diabetes mellitus (DM) was identified in 21.2% (n=86) of the 406 patients undergoing cardiac surgery in this cohort. As summarized in Table 1, the median age was 60.5 years in the diabetic group and 51.5 years in the non-diabetic group, with males comprising 80.2% and 55.9% respectively. The median body mass index was 27.0 kg/m² in the diabetic group and 25.8 kg/m² in the non-diabetic group, and the proportion of patients with ASA physical status IV or above was 11.6% and 8.4%, respectively.

Table 2: Types of Surgery

Variables	Diabetic (n=86, 21.2%)	Nondiabetic (n=320,78.8%)	Total (n=406)
Male, n (%)	69(80.2)	179(55.9)	248
Female, n (%)	17(19.8)	141(44.1)	158
Age (years), median (IQR 25% to 75%)	60.50(54-67.25)	51.50(39-60)	-
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In line with international clinical standards that prioritize surgical revascularization for patients with complex metabolic profiles,[12] our data demonstrated a disparity in surgical indications between the two groups (Table 2). Within the diabetic cohort, coronary artery bypass grafting (CABG) was the primary procedure, performed in 84.8% (n=73) of the patients. Within the non-diabetic cohort, CABG accounted for 31.6% (n=101) of the procedures. Valvular interventions within the non-diabetic group included aortic valve surgery at 10.0% (n=32), mitral valve surgery at 19.1% (n=61), and double valve procedures at 20.0% (n=64). For the diabetic cohort, these percentages were documented at 1.2% for aortic valve surgery, 4.7% for mitral valve surgery, and 1.2% for double valve surgery. The concentration of procedures in the diabetic cohort was observed in revascularization interventions, whereas valvular pathologies were documented more frequently within the clinical profiles of the younger non-diabetic population cohort.

Table 3: Post-Operative Complications

Outcomes	Diabetic (n=86)	Nondiabetic (n=320)	Total (n=406)
Re-exploration, n (%)	15(17.4)	51(15.9)	66(16.3)
Surgical site infection, n (%)	4(4.7)	0(0)	4(1.0)
In-hospital mortality due to primary surgery, n (%)	19(22.1)	45(14.1)	64(15.8)
AKI, n (%)	28(32.6)	88(27.5)	116(28.6)
Length of ICU stay (days), median (IQ 25% to 75%)	5 (2.00-5.00)	5(2-4)	-
Duration of post-ICU Hospital stay, days, median (IQR)	3 (2-4)	3 (2-4)	-

The perioperative clinical course and postoperative complications for the study population are summarized in Table 3. The in-hospital mortality rate was 22.1% (n=19) in the diabetic cohort and 14.1% (n=45) in the non-diabetic group. Renal and infectious complications were also documented for both groups. Acute kidney injury (AKI) was recorded at 32.6% of the diabetic group and 27.5% of the non-diabetic group. Furthermore, no surgical site infections (SSIs) were recorded among non-diabetic patients, whereas 4.7% (n=4) of the diabetic cohort developed this complication, consistent with the known impact of hyper-glycemia on wound healing and immune response.2 The median length of stay in the ICU was 5 days for both the diabetic group (IQR, 2.00–5.00) and the non-diabetic group (IQR, 2–4), while the median post-ICU hospital stay duration was 3 days for both groups (IQR, 2–4).

Discussion

This study demonstrates that approximately one in five patients undergoing cardiac surgery with cardiopulmonary bypass at a national cardiac center in Nepal has Type II diabetes mellitus. The observed prevalence of 21.2% is lower than the 25–40% reported in large international CABG cohorts, including the Bypass Angioplasty Revascularization Investigation (BARI)[18]. This difference likely reflects underdiagnosis of diabetes in the general Nepalese population, limited access to routine screening, and delayed healthcare engagement in low-resource settings.[1]

Diabetic patients were observed to be older in age in our study cohort reflecting the cumulative metabolic burden associated with aging[4]. Cardiovascular disease remains the leading cause of death among individuals with diabetes, accounting for over 80% of mortality in this population[19,20]. Even at a lower prevalence, the presence of diabetes therefore represents a disproportionate perioperative risk burden within cardiac surgical populations in Nepal.

Diabetes patients showed observed rates of postoperative outcomes, including an observed acute kidney injury (AKI) rate of 32.6% (27.5% in non-diabetic patients), a surgical site infection rate of 4.7% (0% in non-diabetic patients), a re-exploration rate of 17.4% (15.9% in non-diabetic patients), and an in-hospital mortality rate of 22.1% (14.1% in non-diabetic patients) (Table 3). These findings are biologically plausible and align with prior literature linking diabetes to endothelial dysfunction, impaired renal autoregulation, chronic inflammation, and immune dysregulation[7,14,21]. Notably, all surgical site infections occurred in diabetic patients, highlighting the heightened vulnerability of this group and the need for targeted perioperative infection prevention strategies.

The predominance of CABG among diabetic patients is consistent with the high burden of multivessel coronary artery disease observed in patients with Type II DM[5]. Randomized trials and long-term follow-up studies consistently demonstrate superior survival with CABG compared to PCI in diabetics, despite increased early morbidity[22]. This trade-off underscores the importance of meticulous perioperative optimization to mitigate short-term risks while preserving long-term benefit.

The median HbA1c of 7.0% was observed in diabetic patients. Preoperative HbA1c has been shown to predict postoperative mortality, renal injury, and infectious complications following cardiac surgery10. Additionally, perioperative glucose variability, independent of mean glucose levels, has emerged as a strong predictor of adverse outcomes[23]. Together, these findings emphasize the need for systematic HbA1c screening, deferral of elective surgery in poorly controlled diabetes, and protocolized perioperative glycemic management consistent with contemporary cardiac surgical guidelines[24–26].

In resource-limited settings such as Nepal, implementing standardized perioperative diabetes pathways may yield substantial improvements in surgical outcomes with relatively modest resource investment.

Limitations

This study has several limitations. Its retrospective single-center design is subject to information bias and limits generalizability to other cardiac surgical settings in Nepal. Multivariable risk adjustment was not performed; therefore, observed differences between diabetic and non-diabetic patients were not adjusted for potential confounding variables such as age, disease severity, or comorbidities. Detailed perioperative glycemic control data, including intraoperative glucose variability and insulin management protocols, were not available for analysis. Cardiopulmonary bypass–related variables, such as pump time and aortic cross-clamp duration, were also not included. Finally, outcomes were limited to the in-hospital period, and long-term postoperative outcomes were not assessed.

Conclusion

Diabetes mellitus was a common comorbidity among patients undergoing cardiac surgery with cardiopulmonary bypass in this tertiary cardiac center in Nepal. The observed proportions of perioperative complications, such as acute kidney injury and surgical site infections, as well as in-hospital mortality, were documented for both the diabetic and non-diabetic cohorts. These descriptive data highlight the clinical profile of this patient population and suggest that routine diabetes screening, preoperative HbA1c assessment, and structured perioperative glycemic management pathways may support perioperative care optimization in this setting.

Conflict of interest:

None

Funding Statement:

This study did not receive any external funding.

Data Availability Statement:

De-identified data supporting the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions:

Study conception and design: [Ashish Govinda Amatya, Ashok Pudasaini, Prasanna Pandey]. Data collection: [Ashok Pudasaini, Battu Kumar Shrestha, Sandip Bhandari, Abhay Khadka]. Data analysis and interpretation: [Ashok Pudasaini, Ashish Govinda Amatya, Swastika Poudel,,Smriti M Bajracharya]. Manuscript drafting and revision: all authors. All authors approved the final manuscript.

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