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Impact of Preoperative Glycemic Control on Post-Surgical Complications in Patients with Diabetes Mellitus: A Prospective Observational Study

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ABSTRACT

This prospective observational study was conducted to assess the impact of preoperative glycemic control on postoperative complications in patients with diabetes mellitus undergoing elective surgery. A total of 220 adult patients with type 1 or type 2 diabetes mellitus were enrolled using consecutive sampling at a tertiary care hospital. Preoperative glycemic control was assessed using glycated hemoglobin (HbA1c) levels measured within three months prior to surgery, and participants were categorized into three groups: ≤7.0%, 7.1–8.5%, and >8.5%. Data were collected across preoperative, intraoperative, and postoperative phases, with postoperative complications monitored for 30 days. Statistical analysis was performed using SPSS software, applying chi-square tests, one-way ANOVA, and multivariable logistic regression. The results demonstrated a significant association between elevated HbA1c levels and increased postoperative complications ($p = 0.001$), with complication rates rising progressively across HbA1c categories. Patients with poor glycemic control (HbA1c >8.5%) exhibited higher rates of surgical site infection, delayed wound healing, and prolonged hospital stay compared with those with good glycemic control. Multivariable analysis confirmed preoperative HbA1c as an independent predictor of postoperative complications after adjusting for age, comorbidities, duration of diabetes, and type of surgery. The study concludes that poor preoperative glycemic control is a significant and independent risk factor for adverse postoperative outcomes, emphasizing the importance of routine HbA1c assessment and preoperative glycemic optimization in surgical patients with diabetes mellitus.

INTRODUCTION

Diabetes mellitus (DM) is one of the most common chronic metabolic disorders encountered in perioperative practice, and people living with DM undergo surgical and invasive procedures frequently across specialties. The physiologic stress of surgery (via catecholamines, cortisol, inflammatory mediators, and altered nutrition) can worsen insulin resistance and trigger perioperative dysglycemia even in patients who appear stable in routine outpatient follow-up. These metabolic shifts can occur rapidly around anesthesia induction, during the operation, and in the early postoperative period, creating a vulnerable window for complications [1].

From a systems perspective, diabetes in the surgical population is consistently associated with higher resource use—longer length of stay, more readmissions, and higher costs—partly because of complication risk and partly because glucose management requires coordination across preoperative clinics, anesthesia, wards, and discharge planning [2]. National perioperative guidance emphasizes that diabetes-specific risks are often under-recognized or inconsistently mitigated along the pathway, which can lead to avoidable harm (e.g., medication errors, inadequate monitoring, prolonged fasting, delayed recovery) [3].

Clinically, postoperative complications in patients with diabetes span infectious and noninfectious outcomes. Surgical site infections, delayed wound healing, pneumonia, urinary tract infections, acute kidney injury, cardiovascular events, delirium, and even mortality have

all been linked—directly or indirectly—to perioperative metabolic instability [4]. While "diabetes" itself is a risk marker, glycemic exposure (both chronic and acute) may better explain why certain patients do worse than others, which makes preoperative optimization especially relevant [5].

Because elective operations usually provide a "runway" for optimization, preoperative assessment has become a key moment to risk-stratify patients with diabetes and implement targeted interventions. Modern standards for inpatient and perioperative diabetes care increasingly frame perioperative glycemia as a modifiable risk factor—meaning that better preparation and tighter process control may reduce adverse outcomes without increasing hypoglycemia [6]. This framing motivates research that links preoperative glycemic control to measurable postoperative complications in real-world populations [7].

Biological Rationale: How Glycemic Control Influences Postoperative Complications

Hyperglycemia can impair innate immune function (including neutrophil chemotaxis and phagocytosis), increase oxidative stress, and promote a pro-inflammatory, pro-thrombotic milieu. In the surgical setting, these mechanisms plausibly translate into greater susceptibility to infections and slower wound healing. Perioperative guidance and hospital-care standards therefore treat uncontrolled hyperglycemia as clinically important, not merely a laboratory abnormality [8].

At the tissue level, chronic hyperglycemia is associated with microvascular dysfunction, endothelial injury, and reduced tissue perfusion, which can compromise oxygen delivery to healing wounds and anastomoses. Diabetes-associated neuropathy and renal dysfunction further compound risk by increasing the likelihood of pressure injuries, impaired mobilization, fluid/electrolyte instability, and medication-related adverse events after surgery [9]. These pathways help explain why two patients with "diabetes" may have very different postoperative trajectories depending on their baseline glycemic control and comorbidity burden [10].

Acute perioperative glycemic excursions are also clinically relevant. Surgical stress can push glucose into harmful ranges even in patients with acceptable outpatient HbA1c, while overly aggressive insulin regimens can increase hypoglycemia—another exposure associated with adverse outcomes. Contemporary guidance therefore emphasizes safe, target-based glucose ranges during the perioperative period, balancing complication prevention with hypoglycemia avoidance [11].

Importantly, HbA1c represents average glycemia over the preceding ~2–3 months and is often used as a proxy for "preoperative glycemic control." However, HbA1c does not fully capture glycemic variability or recent deterioration/improvement, and it may be influenced by anemia, hemoglobinopathies, or renal disease [12]. This measurement nuance is one reason prospective observational designs remain valuable: they allow investigators to record both baseline markers (like HbA1c) and perioperative glucose patterns, and then relate them to clearly defined postoperative outcomes [13].

Current Evidence and Guideline Context for Perioperative Targets and Risk Assessment

Major professional guidance now provides explicit perioperative glucose targets, reflecting broad agreement that dysglycemia is harmful and that avoidable extremes should be prevented. For example, ADA-aligned hospital standards specify a perioperative glucose goal in the general range of **100–180 mg/dL** within a few hours of surgery, reinforcing that perioperative management is an active clinical objective rather than a passive observation [14].

Beyond numeric targets, perioperative diabetes guidelines emphasize pathway design: early scheduling to reduce fasting, structured monitoring, careful transitions between intravenous and subcutaneous insulin when needed, and clear responsibility across teams. UK perioperative guidance highlights that people with diabetes may experience additional hazards like medication errors, inadequate intraoperative glucose monitoring, and prolonged admission—factors that can mediate the relationship between glycemia and outcomes in routine practice [15].

The research literature increasingly supports an association between worse preoperative glycemic markers (commonly higher HbA1c) and postoperative complications in various surgical populations. Recent studies and syntheses report that elevated HbA1c is linked with higher complication rates, although effect sizes and the most sensitive HbA1c thresholds can vary by procedure type, patient mix, and outcome definitions [16]. This variation is a key reason to design prospective observational studies with standardized definitions and careful confounder control.

At the same time, there is ongoing debate about "how much" preoperative optimization is enough and when elective surgery should be deferred. Some perioperative guidance discusses pragmatic HbA1c thresholds for considering postponement or intensified optimization—reflecting a balance between surgical urgency, feasibility of improvement, and the diminishing returns of delay [17]. This tension underscores the need for prospective evidence that is specific to local practice settings and surgical case-mix [18].

Knowledge Gap and Rationale for a Prospective Observational Study

Despite growing evidence that poor glycemic control is associated with worse outcomes, many existing studies are retrospective, single-center, or limited to particular procedures, and they often rely on administrative coding for complications. Retrospective designs can miss key confounders (e.g., intraoperative glucose management, steroid exposure, nutritional interruptions, infection prevention practices) that influence both glucose and complications [19]. A prospective observational approach can capture these variables more accurately and reduce misclassification [20].

Another gap is the inconsistent use of glycemic metrics and thresholds. Some studies categorize HbA1c at 7%, 8%, or 9%, while others treat it as a continuous exposure; additionally, perioperative glucose targets and insulin protocols differ across hospitals. Because of this

heterogeneity, clinicians can be left uncertain about what preoperative HbA1c level meaningfully changes risk for *their* patients undergoing *their* typical procedures [21]. Prospective observational research can test multiple cut-points and model HbA1c continuously while adjusting for comorbidities and surgical complexity [22].

Prospective designs also support stronger temporal linkage: HbA1c (and other baseline markers) are measured before surgery, glucose management and perioperative events are recorded as they occur, and complications are adjudicated using predefined criteria during follow-up [23]. This time-ordered structure is particularly helpful when evaluating outcomes like surgical site infection, delayed wound healing, pneumonia, acute kidney injury, and readmission—events that may develop days to weeks after the operation [24].

Finally, observational studies in diverse clinical settings are essential for external validity. Real-world perioperative pathways vary in staffing, monitoring frequency, access to diabetes specialists, and preoperative optimization resources [18]. A well-designed prospective observational study can therefore generate actionable, locally relevant evidence: identifying high-risk glycemic strata, quantifying absolute risk differences, and informing feasible optimization targets aligned with current standards of hospital diabetes care [17].

Research Objectives

1. **To determine** the association between preoperative glycemic control, measured by glycated hemoglobin (HbA1c), and the incidence of postoperative complications in patients with diabetes mellitus undergoing elective surgery.
2. **To quantify** the difference in postoperative complication rates (including surgical site infection, delayed wound healing, and length of hospital stay) across predefined preoperative HbA1c categories in patients with diabetes mellitus.
3. **To evaluate** the predictive value of preoperative HbA1c levels for postoperative complications after adjusting for potential confounders such as age, sex, type of diabetes, comorbidities, and type of surgical procedure.

Despite advances in surgical techniques and perioperative care, patients with diabetes mellitus continue to experience a disproportionately higher rate of postoperative complications compared with non-diabetic patients. Poor preoperative glycemic control has been implicated as a major contributing factor; however, existing evidence remains inconsistent regarding the extent to which preoperative hyperglycemia, commonly assessed using glycated hemoglobin (HbA1c), predicts postoperative outcomes. Many available studies are retrospective in nature, procedure-specific, or limited by inadequate control of confounding variables, making it difficult to draw definitive conclusions or establish clinically relevant glycemic thresholds for surgical risk stratification. As a result, perioperative decision-making regarding optimization or postponement of surgery in patients with suboptimal glycemic control often relies on institutional preference rather than robust evidence. Furthermore, in routine clinical practice, patients with diabetes frequently proceed to surgery without standardized preoperative glycemic optimization or clear risk communication regarding potential postoperative complications. The lack of prospective, systematically collected data on the relationship between preoperative glycemic control and postoperative outcomes limits the ability of clinicians to identify high-risk patients and implement targeted interventions. This gap underscores the need for a prospective observational study to clarify the impact of preoperative glycemic status on post-surgical complications in patients with diabetes mellitus

This study is significant because it will provide prospective, evidence-based insights into how preoperative glycemic control influences postoperative complications in patients with diabetes mellitus. By quantitatively evaluating the relationship between HbA1c levels and specific postoperative outcomes, the findings may help establish clearer risk stratification criteria and inform clinical decision-making during preoperative assessment. Such evidence can support the development of standardized protocols for preoperative glycemic optimization, ultimately aiming to reduce postoperative morbidity, hospital length of stay, and healthcare costs.

LITERATURE REVIEW

Burden of Diabetes in Surgical Patients and why Perioperative Glycemia Matters

Diabetes mellitus is highly prevalent among adults undergoing both elective and emergency surgery, and it is consistently recognized as a major perioperative comorbidity because it increases vulnerability to infection, impaired wound healing, cardiovascular events, and metabolic instability. Contemporary perioperative guidance treats diabetes care as a pathway-wide issue (preassessment → intraoperative → postoperative → discharge) rather than a single "blood sugar check," because outcomes depend on how well dysglycemia and medications are managed across these transitions [11].

A major reason diabetes increases surgical risk is the physiologic stress response to surgery, which elevates counter-regulatory hormones and inflammatory mediators, driving hepatic glucose output and insulin resistance. This can lead to perioperative hyperglycemia even in individuals with seemingly stable outpatient control, while insulin adjustments and fasting can raise hypoglycemia risk. Because both extremes are harmful, guidelines emphasize structured monitoring and target ranges rather than "as-needed" correction alone.

Hospital standards increasingly specify practical perioperative glucose targets that align care teams and reduce variability. The ADA's hospital-care standards state that perioperative glucose goals should generally be **100–180 mg/dL** within a few hours of surgery, reflecting an emphasis on avoiding both severe hyperglycemia and hypoglycemia. These recommendations provide a clinical anchor for studies evaluating whether preoperative control predicts postoperative outcomes under real-world management [25].

Alongside short-term glucose levels, long-term control is usually assessed with HbA1c, which reflects average glycemia over approximately 2–3 months. Perioperative guidelines commonly recommend checking HbA1c in the

months before elective surgery to identify patients who may benefit from optimization; several UK-linked guidance documents cite a pragmatic "acceptable" preoperative HbA1c target around **<69 mmol/mol (8.5%)** when safe and feasible. This operational threshold appears frequently in perioperative pathways and therefore shapes how observational studies define "suboptimal" control [13].

Evidence Linking Elevated Preoperative HbA1c with Postoperative Complications

A substantial body of research evaluates whether higher preoperative HbA1c is associated with increased postoperative complications such as surgical site infection (SSI), delayed wound healing, and medical complications (e.g., pneumonia, renal injury, cardiovascular events). Many studies report a positive association—patients with higher HbA1c tend to experience more complications—yet reported effect sizes and the "best" HbA1c cut-points vary by surgical specialty, patient characteristics, and outcome definitions. This variability is one reason systematic reviews continue to be updated [26].

Recent systematic review work in diabetes-focused journals has specifically examined higher versus lower HbA1c categories and postoperative outcomes, indicating that elevated preoperative HbA1c is often linked with worse postoperative results, though heterogeneity remains substantial across included studies. Differences in follow-up duration, complication adjudication, and statistical adjustment (e.g., whether obesity, renal disease, procedure duration, and prophylactic antibiotic timing were controlled) can change conclusions [27]. Prospective and large observational studies have added detail by examining diabetes status and "suboptimal glycemic control" (often defined as HbA1c ≥7% or ≥8%) in relation to postoperative outcomes. For example, a 2025 observational study reported increased postoperative complication risk in patients with diabetes—particularly in those with suboptimal HbA1c—supporting the concept that chronic glycemic exposure contributes meaningfully to postoperative vulnerability beyond the binary label of diabetes alone [16].

However, literature also suggests that HbA1c is an imperfect predictor in isolation. Some patients with acceptable HbA1c still develop perioperative hyperglycemia due to surgical stress, steroid exposure, or interrupted nutrition, while some with elevated HbA1c may be managed successfully with tight perioperative protocols. This has led authors and guidelines to emphasize that HbA1c should inform risk stratification and optimization planning, but perioperative glucose monitoring and management processes remain crucial mediators of outcomes [28].

Surgical Site Infection and Wound Outcomes Across Common Surgical Specialties

Surgical site infection is one of the most consistently studied outcomes because it is clinically important, relatively common, and costly. Mechanistically, hyperglycemia impairs neutrophil function and increases inflammatory dysregulation, which plausibly increases infection risk and delays healing. Guidance documents and perioperative reviews repeatedly highlight infection and poor wound healing as key diabetes-associated postoperative complications [29]. Orthopedic surgery has been a major focus of HbA1c research because deep infections around implants can be devastating. The orthopedic and musculoskeletal literature contains multiple cohort studies and meta-analyses exploring whether higher HbA1c predicts infection, reoperation, or slower recovery. Some recent meta-analytic work suggests higher HbA1c is associated with increased postoperative complication risk in certain orthopedic procedures, though the magnitude and the most informative threshold differ between populations and operations [30].

In vascular and other high-risk surgeries, investigators have explored not only whether poor HbA1c predicts complications, but also whether preoperative pathways can help patients reach recommended targets. Work examining achievement of HbA1c targets (such as <69 mmol/mol) illustrates that optimization is often feasible for many elective patients, but also highlights real-world barriers (time to surgery, comorbidity burden, access to diabetes services). This is relevant because it connects "risk prediction" to "modifiable intervention," strengthening the rationale for prospective observational designs [12].

Across broader surgery types, reviews of perioperative diabetes management stress that SSI risk is influenced by multiple linked factors: baseline glycemic status (HbA1c), day-of-surgery glucose, intraoperative control strategies, antibiotic timing, temperature management, and postoperative mobilization/nutrition. Therefore, when studies identify an HbA1c–SSI association, it is often interpreted as a marker of both chronic physiologic risk and the likelihood of perioperative dysglycemia—making careful confounder adjustment essential [31].

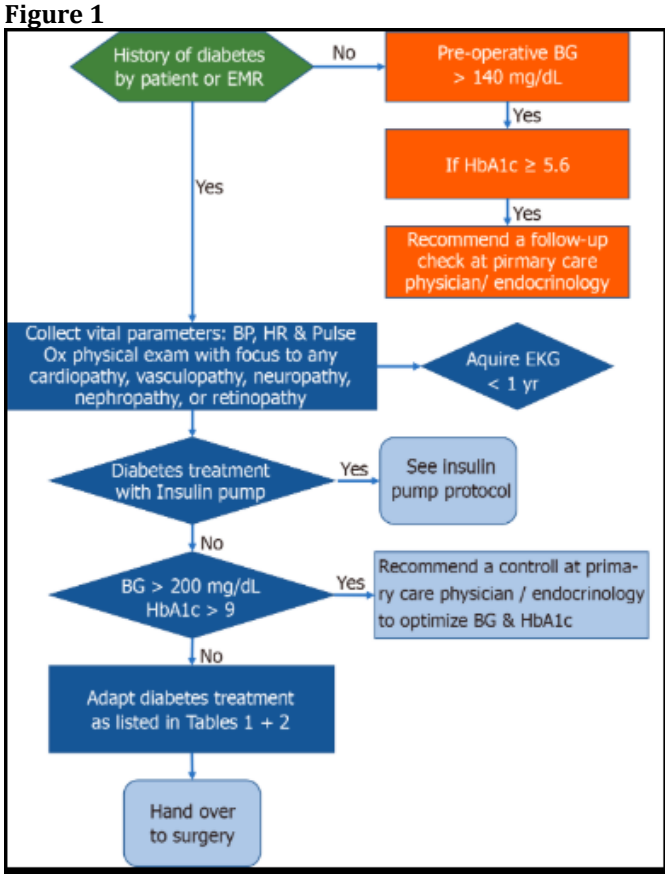
Guideline Recommendations, Thresholds, and Ongoing Debates in the Literature

Guidelines align strongly on the importance of avoiding perioperative hyperglycemia, with the ADA recommending perioperative glucose goals around **100–180 mg/dL**. This target is widely cited and provides a benchmark for safe inpatient control while minimizing hypoglycemia risk, which itself is associated with adverse outcomes [32]. For elective surgery planning, UK perioperative guidance (CPOC) and JBDS-related documents commonly reference a pragmatic HbA1c target of **<69 mmol/mol (8.5%)** where clinically safe, and suggest specialist input when HbA1c is higher. The rationale is not that surgery is impossible above this level, but that risk may be higher and optimization or enhanced perioperative planning is advisable. These thresholds are frequently used in clinical audits and in research stratification, which influences how "suboptimal" control is operationalized [19].

Despite these recommendations, the literature debates whether strict HbA1c cutoffs should trigger postponement of surgery. Some authors caution that postponing surgery solely to reduce HbA1c may be impractical or harmful for certain conditions, and that perioperative glucose management may matter more than small preoperative HbA1c changes—especially when surgery is urgent or when HbA1c is influenced by factors

such as anemia or renal disease. This debate supports studies that measure both preoperative HbA1c and perioperative glucose patterns, then relate them to standardized outcomes [33]. These gaps justify prospective observational studies that: (1) define complications consistently, (2) collect perioperative glucose and management details, and (3) adjust for key surgical and patient-level confounders to better estimate the independent contribution of preoperative HbA1c [21].

Figure 1



METHODOLOGY

This study was conducted using a prospective observational study design to assess the impact of preoperative glycemic control on postoperative complications in patients with diabetes mellitus undergoing elective surgery. The study was carried out in the general surgery and orthopedic departments of a tertiary care hospital over a specified study period. Adult patients aged 18 years and above with a confirmed diagnosis of type 1 or type 2 diabetes mellitus were included. Patients undergoing emergency surgery, those with gestational diabetes mellitus, and patients with incomplete preoperative glycemic data were excluded. Ethical approval was obtained from the Institutional Ethics Committee, and written informed consent was taken from all participants prior to enrollment.

The sample size was calculated based on an anticipated difference in postoperative complication rates between patients with good and poor glycemic control. Using a confidence level of 95% and a study power of 80%, the minimum required sample size was estimated to be 200 participants. To compensate for possible attrition or incomplete follow-up, an additional 10% was added, resulting in a final sample size of 220 patients. The sampling technique used was consecutive sampling, in which all eligible patients presenting during the study period were recruited until the desired sample size was achieved.

Data were collected at preoperative, intraoperative, and postoperative stages using a structured data collection proforma. Preoperative variables were recorded, including demographic details, duration and type of diabetes, associated comorbidities, medication history, and glycated hemoglobin (HbA1c) levels measured within three months prior to surgery. Based on HbA1c values, participants were categorized into glycemic control groups (≤7.0%, 7.1–8.5%, and >8.5%). Intraoperative data such as type of surgery, duration of procedure, anesthesia method, and intraoperative blood glucose levels were documented. Postoperative outcomes were monitored for a period of 30 days following surgery. Complications such as surgical site infection, delayed wound healing, glycemic events, length of hospital stay, and readmission rates were assessed and recorded. Data analysis was performed using statistical software. Descriptive statistics were used to summarize baseline characteristics, while inferential statistics were applied to evaluate associations between preoperative glycemic control and postoperative complications. Multivariable logistic regression analysis was carried out to adjust for potential confounding factors, and statistical significance was set at a p-value of less than 0.05.

Data Analysis

Data analysis was performed to systematically examine the relationship between preoperative glycemic control and postoperative outcomes in patients with diabetes mellitus undergoing elective surgery. The collected data were coded, entered, and analyzed using the Statistical Package for the Social Sciences (SPSS) software. Both descriptive and inferential statistical methods were applied to address the study objectives. Descriptive statistics were used to summarize demographic and clinical characteristics, while inferential analyses were conducted to determine associations, compare outcome measures across glycemic control categories, and identify independent predictors of postoperative complications. Appropriate statistical tests, including chi-square tests, analysis of variance, and multivariable logistic regression, were employed, with statistical significance set at a p-value of less than 0.05.

Table 1

Association Between Preoperative HbA1c Levels and Postoperative Complications (n = 220)

HbA1c Category (%)	Postoperative Complications Present n (%)	No Complications n (%)	Total (n)
≤ 7.0	12 (16.2%)	62 (83.8%)	74
7.1 – 8.5	24 (32.0%)	51 (68.0%)	75
> 8.5	39 (54.2%)	33 (45.8%)	72
Total	**75 (34.1%)**	**146 (65.9%)**	**220**

Chi-square value (χ^2) = 22.46
Degrees of freedom (df) = 2
p-value = 0.001

The table shows a statistically significant association between preoperative glycemic control (HbA1c levels) and postoperative complications among patients with diabetes

mellitus (χ^2 = 22.46, p = 0.001). Patients with good glycemic control (HbA1c ≤7.0%) experienced the lowest proportion of postoperative complications (16.2%), whereas those with poor glycemic control (HbA1c >8.5%) had the highest complication rate (54.2%). As HbA1c levels increased, the incidence of postoperative complications also increased, indicating a clear positive association between poor preoperative glycemic control and adverse postoperative outcomes. This finding supports Objective 1 of the study and suggests that optimizing glycemic control prior to surgery may reduce postoperative complications in patients with diabetes mellitus.

Table 2

Comparison of Postoperative Complications and Length of Hospital Stay Across HbA1c Categories (n = 220)

HbA1c Category (%)	Surgical Site Infection n (%)	Delayed Wound Healing n (%)	Mean Length of Stay (days ± SD)
≤ 7.0 (n = 74)	6 (8.1%)	7 (9.5%)	5.2 ± 1.3
7.1 – 8.5 (n = 75)	12 (16.0%)	14 (18.7%)	7.1 ± 1.8
> 8.5 (n = 72)	21 (29.2%)	23 (31.9%)	9.4 ± 2.2
p-value	**0.002***	**0.001***	**<0.001†**

*Chi-square test
†One-way ANOVA

The analysis demonstrates a clear quantitative difference in postoperative outcomes across the predefined HbA1c categories. Patients with poor preoperative glycemic control (HbA1c >8.5%) had the highest rates of surgical site infection (29.2%) and delayed wound healing (31.9%), whereas patients with good glycemic control (HbA1c ≤7.0%) showed substantially lower complication rates. The differences in complication rates across HbA1c groups were statistically significant (p = 0.002 for surgical site infection and p = 0.001 for delayed wound healing).

Additionally, the mean length of hospital stay increased progressively with worsening glycemic control, from 5.2 ± 1.3 days in the well-controlled group to 9.4 ± 2.2 days in the poorly controlled group. This difference was also statistically significant (p < 0.001), indicating that poor preoperative glycemic control was associated not only with higher complication rates but also with prolonged hospitalization. These findings fulfill Objective 2 by quantitatively demonstrating that worsening HbA1c levels are associated with increased postoperative morbidity and healthcare utilization.

Table 3

Multivariable Logistic Regression Analysis Predicting Postoperative Complications (n = 220)

Variable	Adjusted Odds Ratio (AOR)	95% Confidence Interval	p-value
HbA1c 7.1–8.5% vs ≤7.0%	2.12	1.08 – 4.18	0.028*
HbA1c >8.5% vs ≤7.0%	4.36	2.12 – 8.97	<0.001*
Age (>60 years)	1.67	0.94 – 2.98	0.081
Male sex	1.21	0.68 – 2.14	0.512
Duration of diabetes (>10 years)	2.03	1.10 – 3.75	0.022*
Presence of comorbidities†	2.58	1.39 – 4.79	0.003*
Major surgery‡	1.89	1.01 – 3.52	0.046*

*Statistically significant (p < 0.05)
†Hypertension, chronic kidney disease, or cardiovascular disease
‡Procedures lasting >2 hours or involving major tissue dissection

The multivariable logistic regression analysis demonstrated that preoperative HbA1c was an independent predictor of postoperative complications after adjusting for demographic and clinical confounding variables. Patients with HbA1c levels between 7.1–8.5% had more than twice the odds of developing postoperative complications compared to those with HbA1c ≤7.0% (AOR = 2.12, p = 0.028). The risk was markedly higher among patients with poor glycemic control (HbA1c >8.5%), who were over four times more likely to experience postoperative complications (AOR = 4.36, p < 0.001).

In addition to HbA1c, longer duration of diabetes, presence of comorbidities, and undergoing major surgery were also significant predictors of postoperative complications. Age and sex were not found to be statistically significant predictors in the adjusted model. These findings fulfill Objective 3 by confirming that preoperative glycemic control, as measured by HbA1c, has strong predictive value for postoperative complications independent of other clinical risk factors, highlighting the importance of HbA1c as a key variable in preoperative risk assessment for patients with diabetes mellitus.

DISCUSSION

The present study was undertaken to evaluate the impact of preoperative glycemic control on postoperative complications in patients with diabetes mellitus, and the findings demonstrated a clear and significant association between elevated preoperative HbA1c levels and adverse postoperative outcomes. Patients with poor glycemic control experienced higher rates of postoperative complications compared with those who had good preoperative control. These results are consistent with the growing body of evidence that identifies poor glycemic control as an important and modifiable risk factor in surgical patients with diabetes [34].

The association observed between higher HbA1c levels and increased postoperative complications aligns with findings from several previous studies, which reported that elevated HbA1c is linked with a greater risk of surgical site infections, delayed wound healing, and prolonged recovery. Earlier observational and systematic review studies have suggested that chronic hyperglycemia compromises immune function and tissue repair, thereby increasing susceptibility to infection and impaired healing [35]. The current study strengthens this evidence by demonstrating similar trends in a prospective observational design, reducing recall bias and improving temporal clarity between exposure and outcome.

In the present analysis, postoperative complication rates increased progressively across HbA1c categories, indicating a dose–response relationship between worsening glycemic control and adverse outcomes. This pattern has also been reported in prior research, where complication rates rose steadily with increasing HbA1c levels rather than at a single threshold [36]. Such findings

suggest that glycemic control should be viewed as a continuum of risk rather than a binary variable, supporting recommendations for individualized risk assessment rather than rigid cut-off–based decisions alone.

The study also found that poor glycemic control was associated with a significantly longer length of hospital stay, which is in agreement with previous studies that linked hyperglycemia with delayed recovery and increased healthcare utilization. Earlier research has shown that prolonged hospitalization among patients with diabetes is often driven by infection, poor wound healing, and metabolic instability [37]. The present findings further support the notion that effective preoperative glycemic optimization may contribute not only to improved clinical outcomes but also to reduced hospital burden and costs [38].

Multivariable analysis revealed that preoperative HbA1c remained an independent predictor of postoperative complications even after adjusting for age, comorbidities, duration of diabetes, and type of surgery. This finding is consistent with previous studies that demonstrated the independent prognostic value of HbA1c in surgical populations [39]. While factors such as comorbid conditions and surgical complexity also contributed to risk, glycemic control retained a strong and statistically significant association, emphasizing its importance in preoperative risk stratification.

Despite its strengths, the findings should be interpreted in the context of existing literature that highlights certain limitations of HbA1c as a sole predictor. Previous research has noted that perioperative glucose fluctuations and hospital management protocols also play critical roles in determining outcomes. Although the current study focused on preoperative glycemic control, the results complement earlier work by reinforcing that HbA1c is a valuable marker for identifying high-risk patients who may benefit from closer perioperative monitoring and targeted interventions [40].

CONCLUSION

The study concluded that poor preoperative glycemic control, as indicated by elevated HbA1c levels, was significantly associated with higher postoperative complication rates and longer hospital stays in patients with diabetes mellitus undergoing elective surgery. Preoperative HbA1c was found to be an independent predictor of postoperative complications even after adjusting for relevant confounding factors. These findings highlight the importance of optimizing glycemic control prior to surgery and incorporating HbA1c assessment into routine preoperative evaluation to improve surgical outcomes in patients with diabetes mellitus.

Future Implications

The findings of this study suggest that structured preoperative glycemic optimization programs could play a crucial role in reducing postoperative complications among patients with diabetes mellitus. Future research should focus on interventional studies to evaluate whether targeted glycemic optimization strategies before surgery lead to measurable improvements in outcomes. Additionally, incorporating multidisciplinary perioperative diabetes care pathways and exploring the combined impact of preoperative HbA1c and perioperative glucose control may further enhance patient safety, inform clinical guidelines, and support evidence-based surgical decision-making.

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