

## Optimizing Perioperative Management for Diabetic Patients Undergoing Non-Cardiac Surgery: A Retrospective Cohort Study

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### Abstract:

**Background:** Patients with diabetes who undergo surgery are at a greater risk for perioperative issues, although the significance of preserving stable blood sugar levels is still under investigation. In addition to perioperative HbA1c levels, perioperative glucose management and postoperative glycemic control may influence surgical outcomes. Understanding the relationship between glycemic management and surgical results is necessary for optimising care.

**Methods:** For this investigation, the Electronic Health Records (EHR) of 500 patients with diabetes who experienced non-cardiac surgery between January 1, 2022, and December 31, 2022, were retrospectively reviewed. Evaluations were conducted on intraoperative glucose management, postoperative glycemic control, and perioperative HbA1c levels. The data were analysed using descriptive statistics and inferential tests, with p-values less than 0.05 considered statistically significant.

**Results:** In the sample population, higher surgical site infection rates were observed (48% had HbA1c levels > 8%; p < 0.05). Patients whose intraoperative blood glucose levels were within the normal range (100-150 mg/dL) had a decreased incidence of cardiovascular events. Postoperative hyperglycemia (> 180 mg/dL) has been associated with wound complications and extended hospital stays.

**Conclusions:** During the perioperative period, diabetic surgical patients must have their blood sugar levels optimally managed. Perioperative assessment and optimisation, intraoperative care, and postoperative observation are crucial phases. The importance of optimising glycemic management for each diabetic patient to enhance surgical outcomes is highlighted by our findings.

**Keywords:** Diabetes, Glycemic Control, Non-Cardiac Surgery, Perioperative Management, Surgical Outcomes.

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### Introduction

The chronic metabolic condition diabetes mellitus, characterised by hyperglycemia, is now a worldwide epidemic. Non-cardiac procedures performed on diabetic patients have increased in frequency alongside the rising incidence of diabetes [1].

Healthcare personnel encounter complex challenges when caring for these patients in the perioperative period [2]. To provide the best possible perioperative care for diabetes patients undergoing non-cardiac surgery, this paper will investigate and address critical issues in this area. Over the past few decades, diabetes has become increasingly common, and along with it, the number of diabetic patients needing non-cardiac procedures. Optimal surgical results and minimal complications can only be achieved by meticulous perioperative treatment of these individuals [3].

The relationship between diabetes and surgical options is complex; planned and unexpected surgical procedures present particular difficulties for diabetic individuals [4].

Complications such as wound infection, slow healing of the wound, cardiovascular events, and postoperative hyperglycemia are more common in people with diabetes, which can have a negative effect on surgical results [5].

Perioperative care of diabetes patients is often complicated by comorbidities, including hypertension and obesity. Patients with diabetes make up a sizable proportion of the surgical population, making it critical to find ways to improve their perioperative care. Increased morbidity, more extended hospital stays, and higher healthcare expenses might come from substandard care [6]. Conversely, these risks can be

reduced and surgical outcomes improved with careful management of this patient population.

### Challenges and Risks

Surgical procedures position unique difficulties and risks for people with diabetes. Increased risk of infection at the surgical site and delayed wound healing have been associated with hyperglycemia throughout the perioperative period [7].

Myocardial infarction and arrhythmias are two examples of cardiovascular problems that are more common in diabetic patients during and after surgery. According to the stress response during surgery and the possibility of regular disturbances, such as fasting, it might be difficult to keep blood sugar levels stable [8]. Perioperative glycemic control can also be affected by changes in perioperative medication regimes for diabetic patients, particularly insulin [9]. Diabetic neuropathy can make it harder to spot problems after surgery.

### Objectives

- To evaluate the current perioperative, intraoperative, and postoperative practices for managing diabetic patients.
- To determine whether or not perioperative glycemic control affects surgical outcomes such as infection rates, wound healing, cardiovascular events, and duration of hospital stay.
- To determine current standards of care for diabetic patients undergoing non-cardiac surgery and areas where these standards could be enhanced.

### Prevalence and Impact on Surgical Outcomes

Diabetes has been shown to have a significant effect on surgical results, according to recent research. Impaired immunological response, microvascular dysfunction, and delayed wound healing are the underlying mechanisms behind these unfavourable effects of hyperglycemia.

### Perioperative Management

Various organisations have established guidelines to assist healthcare providers in managing patients with diabetes in the perioperative situation [10]. Recommendations for glycemic control before, during, and after surgery have been issued by the American Diabetes Association (ADA) and the American Association of Clinical Endocrinologists (AACE). Glycemic control, coexisting conditions, and the risk for diabetes-related complications should all be evaluated before surgery.

Perioperative glucose management is essential for a successful surgical outcome. Normal blood sugar levels help prevent infections and speed up recovery from wounds.

Insulin infusion, regular blood sugar testing, and medication modifications are all effective methods

for managing diabetes [11,12]. To avoid hyperglycemia and its consequences, postoperative glucose monitoring is crucial. The appropriate perioperative glycemic goal is debatable. Thus, the ideal range for glycemic management and hypoglycemia avoidance remains unknown. There is disagreement about whether to take antidiabetic drugs before, during, or after surgery. Patient-specific characteristics, including renal function and cardiovascular status, may require a distinct care approach after surgery. It is unclear how preexisting diseases like diabetic neuropathy and retinopathy affect surgery outcomes. One must understand how these factors affect perioperative management and patient outcomes to customise therapies to individual needs.

### Methodology

#### Study Design

The perioperative care of diabetes patients experiencing non-cardiac surgery was the focus of this retrospective study. Clinical practises and outcomes can be studied over time which entail collecting and analysing historical data from medical records.

#### Data Source

Patients' EHRs from primary tertiary care were the study's major data source. EHRs provide a centralised and easily available database for all aspects of a patient's medical history, from demographics through pre-and postoperative exams and results. A large and diversified patient sample was possible because of EHR data, which increased the study's validity outside the study.

#### Inclusion/Exclusion Criteria

Certain inclusion and exclusion criteria were created to guarantee the applicability and precision of the information. Patients with diabetes mellitus who underwent non-cardiac surgery between January 1, 2022, and December 31, 2022, were included in the study. Patients must be above 18 years old to be eligible.

Type 1 diabetics, patients undergoing cardiac surgery, and those whose medical records were either missing or insufficient were not included in the study; excluding cardiac procedures allowed for more narrowly focused research into the perioperative problems associated with non-cardiac surgical procedures.

#### Data Collection and Analysis

A staff of experienced study assistants evaluated eligible patients' medical records. Patient age and gender were recorded, as well as perioperative assessments of glycemic control, comorbidities, and diabetic complications; procedure and anaesthetic information; glycemic management during and after surgery; and in- and out-patient

surgical outcomes such as infection rates, wound healing times, and length of hospital stay. Statistical programmes were used to analyse the data. Means, deviations from the mean, frequencies, and percentages were used as descriptive statistics to summarise patient and perioperative variables. The effect of perioperative hyperglycemia management on surgical outcomes was evaluated using a comparative analysis. Statistical significance was set at  $p < 0.05$  for all chi-squared tests, t-tests, and logistic regression analyses.

#### Ethical considerations

This study's ethical considerations included respect to the Declaration of Helsinki, local regulations, and patient confidentiality. The Institutional

Review Board (IRB) approved the research protocol, which included using data from EHR providing compliance with ethical standards for human subject research and protecting patient confidentiality by HIPAA regulations.

#### Results

##### Demographic Characteristics of the Study Population

Patients with diabetes who underwent non-cardiac surgery at a primary tertiary care hospital between January 1, 2022, and December 31, 2022, were included in the study. Table 1 below summarises the demographic characteristics of the patient population.

**Table 1: Demographic Characteristics of Study Population (N=500)**

Characteristic	Number (%)
<b>Age (Years)</b>	
Mean $\pm$ SD	55.7 $\pm$ 9.2
Median (range)	56 (36-78)
<b>Gender</b>	
Male	280 (56%)
Female	220 (44%)
<b>Comorbidities</b>	
Hypertension	250 (50%)
Obesity	130 (26%)
Other	120 (24%)
<b>Diabetic Complications</b>	
Neuropathy	200 (40%)
Retinopathy	180 (36%)
Nephropathy	120 (24%)

#### Perioperative Glycemic Control

Suboptimal perioperative glycemic management, measured by HbA1c values of more than 8%, was found in 200 patients (40%) in the study sample. The need for perioperative glycemic optimisation was highlighted because this group had a significantly greater incidence of surgical site infections ( $p < 0.05$ ).

**Table 2: Perioperative Glycemic Control and Surgical Site Infections**

Perioperative HbA1c Levels (%)	Number of Patients	Surgical Site Infections (%)
$\leq 8\%$	260	15.4
$> 8\%$	240	29.6

Patients with HbA1c levels greater than or equal to 8% had a significantly higher infection rate ( $p < 0.05$ ).

**Intraoperative Glycemic Management** Insulin infusion was used to manage blood sugar levels during surgery for 90% of patients (450 out of 500). Patients who maintained glucose levels within the normal range (100–150 mg/dL) throughout surgery had a significantly lower risk of postoperative cardiovascular events ( $p < 0.05$ ).

**Table 3: Intraoperative Glycemic Control and Postoperative Cardiovascular Events**

Intraoperative Glucose Levels (mg/dL)	Number of Patients	Postoperative Cardiovascular Events (%)
100-150	350	8.7
Others	150	18.6

( $p < 0.05$ ) for patients with glucose levels between 100 and 150 mg/dL had a lower incidence of cardiovascular events than those with glucose levels outside of this range.

**Postoperative Glycemic Control:** Patients with postoperative hyperglycemia (blood glucose levels greater than 180 mg/dL) numbered 180 (36%). The incidence of wound complications was higher (42%), and hospital stays were more extended (8.2 days on average) in this group compared to those with well-controlled postoperative glycemia. Better surgical outcomes were linked to timely measures to stabilise blood sugar levels after surgery.

**Table 4: Postoperative Glycemic Control and Surgical Outcomes**

Postoperative Blood Glucose Levels (mg/dL)	Number of Patients	Wound Complications (%)	Length of Hospital Stay (Mean ± SD)
≤ 180	320	18.1	5.6 ± 2.3
> 180	180	42.2	8.2 ± 3.1

Patients whose postoperative glucose levels were greater than 180 mg/dL had a substantially higher incidence of wound complications ( $p < 0.05$ ) and longer hospital stays.

Several statistically significant findings with clinical importance emerged from this cohort of 500 diabetes individuals receiving non-cardiac surgery. Nearly half of the patients had an increased risk of surgical site infections due to inadequate perioperative glucose management.

Reducing the risk of postoperative cardiovascular events has been associated with vigilant intraoperative glycemic management, with target glucose levels between 100 and 150 mg/dL.

Furthermore, postoperative hyperglycemia was associated with wound complications and longer hospital admissions, highlighting the importance of glycemic control following surgery.

These results highlight the significance of glucose management during surgery in improving diabetes patients' outcomes. Complications, healthcare expenditures, and patient well-being can improve with perioperative optimisation, careful intraoperative treatment, and postoperative hyperglycemia control. More research into individualised regimens for glycemic management is needed for this population.

### Discussion

The results of this study provide important light on the perioperative care of diabetes individuals undergoing non-cardiac procedures. Our findings highlight the significance of glycemic control before surgery by demonstrating a correlation be-

tween perioperative HbA1c levels and the prevalence of surgical site infections. Optimal glycemic control before surgery is critical for lowering the incidence of infections, which were considerably more significant in patients with HbA1c levels above 8%.

In addition, postoperative cardiovascular events were lower in patients who strictly adhered to intraoperative glycemic management, thus demonstrating the importance of preserving normoglycemia throughout the surgery. There needs to be attentive glycemic monitoring and correction after surgery since patients with hyperglycemia have a higher risk of wound complications and longer hospital stays.

### Comparison with Existing Literature

These results are consistent with the literature and recommendations for glycemic control in diabetic patients throughout the perioperative period. Consistent with prior research, high perioperative HbA1c levels have been linked to an increased surgical site infection risk. There is evidence that intraoperative glucose management improves cardiovascular outcomes.

Our findings support current guidelines from groups like the ADA that stress the need for glycemic control in the perioperative period. It also draws attention to better postoperative hyperglycemia management in clinical settings.

**Table 5: Comparison Between Proposed Study and Previous Studies**

Study	Perioperative Glycemic Control	Intraoperative Glycemic Control	Postoperative Glycemic Control
Proposed Study	HbA1c > 8% associated with higher surgical site infection rates ( $p < 0.05$ )	Normoglycemic intraoperative patients (100-150 mg/dL) had fewer cardiovascular events ( $p < 0.05$ )	Postoperative hyperglycemia (> 180 mg/dL) correlated with wound complications and prolonged hospital stays ( $p < 0.05$ )
[13]	Higher HbA1c associated with increased infection rates ( $p < 0.05$ ) in diabetic surgery patients	Improved intraoperative glucose control linked to reduced cardiovascular events ( $p < 0.05$ )	Elevated postoperative glucose levels linked to wound complications and longer hospital stays ( $p < 0.05$ )
[14]	Perioperative HbA1c levels not significantly associated with infection rates	No significant difference in cardiovascular events related to intraoperative glycemic control	No significant correlation found between postoperative glucose levels and wound complications or hospital stay duration
[15]	Elevated perioperative HbA1c levels correlated with higher infection rates ( $p < 0.05$ )	Intraoperative normoglycemia associated with decreased cardiovascular events ( $p < 0.05$ )	Postoperative hyperglycemia associated with increased wound complications and extended hospital stays ( $p < 0.05$ )

The significance of glycemic management in diabetic patients undergoing non-cardiac surgery is shown in this comparative analysis of outcomes from the proposed study and three existing studies. Patients with perioperative HbA1c levels > 8% had considerably increased incidence of surgical site infections, suggesting the need for perioperative glycemic care as shown in the proposed study. Furthermore, the importance of intraoperative glucose control was further emphasised in the suggested study by the correlation between preserving normoglycemia (100-150 mg/dL) during surgery and fewer cardiovascular events. Our findings that postoperative hyperglycemia (> 180 mg/dL) is associated with wound complications and extended hospital stays underscore the need of glycemic management. Previous research supported the present study results, and found different outcomes related to glycemic management in patients before surgery, implying that results may vary. All of these results point to the critical relevance of individualised glycemic management before, during, and after surgery for diabetic patients.

### Conclusion

This research highlights the critical importance of perioperative care optimisation for diabetes patients undergoing non-cardiac surgery. The importance of maintaining stable blood sugar levels throughout surgery is reaffirmed. Perioperative glycemic optimisation is crucial to lessen the likelihood of infection at the surgical site. Cardiovascular events can be reduced with reasonable intraoperative control, and with careful postoperative management, patients can avoid infection and have shorter hospital stays.

This study makes a difference by providing evidence-based guidelines for perioperative care that can generally inform healthcare policies and procedures. Investigating the long-term consequences of optimised perioperative care on the health and healthcare utilisation of diabetic patients is an important area for future study.

### Study Limitations

Despite the valuable information gleaned, this research has several restrictions. First, data from electronic health records, which may be inaccurate or missing, is used in the retrospective design. Second, the study's single-centre design could prevent results from being extrapolated to the public. The results may also be affected by selection bias due to excluding patients with missing data. In addition, the study didn't look into how factors like age, length of diabetes, or surgery type would have affected glycemic control in each patient.

### Recommendations

Several suggestions for improving perioperative care for diabetic patients can be derived from the

results of this study. Patients with HbA1c levels above 8% should be targeted for routine perioperative testing of glycemic management. Improve glycemic control by perioperative treatments. Focus on insulin infusion methods and frequent monitoring to keep glucose levels within the 100-150 mg/dL target range during surgery. Maintaining blood sugar levels below 180 mg/dL in the postoperative phase requires constant glucose monitoring and early actions. When planning perioperative care, consider patient-specific parameters such as age, diabetes duration, and surgical technique.

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