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Outcomes of Diabetic Patients Undergoing Surgical Procedures A Systematic Review

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Abstrak

Diabetes Militus (DM) merupakan kondisi kronis yang mempengaruhi hasil pascaoperasi pada pasien yang menjalani prosedur bedah, meningkatkan risiko komplikasi seperti infeksi luka operasi, penyembuhan lukan menjadi lama, dan dapat menyebapkan kematian. Penelitian ini bertujuan untuk mengevaluasi dampak diabetes terhadap hasil pascaoperasi dan mengidentifikasi factor utama yang mepengaruhi variasi tingkat pemulihan serta komplikasi. Melalui tinjauan sistematis, data dar berbagai literatur yang diterbitkan antara 2019 – 2024 dianalisis untuk menilai pengaruh pemeriksaan kontrol glikemik, komplikasi terkait diabetes, dan protocol pemulihan seperti *Enhanced Recovery After Surgery* (ERAS). Hasil menunjukkan bahwa control glikemik yang optimal dan pengelolaan komplikasi prediabetes, seperti neuropati dan nefropati, sangat penting dalam meningkatkan hasil pascaoperasi. Standarisasi protocol ERAS dan peningkatan literasi Kesehatan juga terbukti efektif. Penelitian in menyoroti perlunya strategi berbasis bukti untuk meminimalkan resiko dan meningkatkan kualitas perawatan bagi pasien diabetes.

Kata Kunci: *Diabetes Militus, Komplikasi Pascaoperasi, Kontrol Glikemik, Pemulihan Operasi, Protokol ERAS.*

Abstract

Diabetes mellitus (DM) is a chronic condition that has a significant impact on postoperative outcomes in surgical patients, increasing the risk of complications such as surgical site infections, delayed wound healing, and mortality. The objective of this study is to evaluate the influence of diabetes on postoperative outcomes and to identify the key factors affecting recovery and complication rates. A systematic review of literature published between 2019 and 2024 was conducted to investigate the effects of glycemic control, diabetes-related complications, and recovery protocols such as Enhanced Recovery After Surgery (ERAS). The findings indicate that optimal glycemic control and management of pre-existing diabetes complications, such as neuropathy and nephropathy, are crucial for improving surgical outcomes. Standardizing ERAS protocols and enhancing health literacy were also identified as effective strategies. This study highlights the necessity for evidence-based approaches to reduce risks and enhance care quality for diabetic patients undergoing surgery.

Keywords: *Diabetes Mellitus, Glycemic Control, Postoperative Complications, Recovery Protocols, ERAS.*

INTRODUCTION

Diabetes Mellitus (DM) is a chronic disease where the body struggles to produce or use insulin properly, leading to damage in vital organs like the heart, nerves, blood vessels, and eyes, while also increasing the risk of infections(J. Wang et al., 2019). According to International Diabetes Federation (IDF) the current 10th edition definitively confirms that diabetes is one of the fastest growing global health emergencies of the 21st century. In 2021, it is estimated that 537 million people have diabetes. This number will reach 643 million by 2030 and 783 million by 2045. Furthermore, it is estimated that 541 million people have impaired glucose tolerance in 2021. Over 6.7 million people aged 20–79 will die from diabetes-related causes in 2021. The number of children and adolescents (i.e., up to 19 years old) living with diabetes is increasing annually. In 2021, over 1.2 million children and adolescents have type 1 diabetes. Direct health expenditures due to diabetes are already close to one trillion USD and will exceed this figure by 2030 (IDF Diabetes Atlas 10th Edition, n.d.)

DM is a chronic condition that significantly complicates surgical outcomes across various procedures. The prevalence of diabetes among surgical patients has increased, leading to heightened concerns regarding postoperative complications (J. Wang et al., 2019; Y. Wang et al., 2022). This condition not only affects patients' quality of life but also contributes to various medical complications, including those related to surgical procedures.

Surgical patients with diabetes are at increased risk for postoper-ative complications, including infections. Moreover, perioperative management of diabetic patients poses unique challenges due to the need for meticulous blood glucose control, potential drug interactions, and comorbidities often associated with diabetes (J. Wang et al., 2020).

Studies have consistently demonstrated that diabetic patients face a higher risk of adverse outcomes, including surgical site infections (SSI), delayed wound healing, and increased mortality rates compared to non-diabetic patients (J. Wang et al., 2019). The underlying pathophysiology involves factors such as impaired immune response, microvascular complications, and metabolic dysregulation, which collectively contribute to the increased susceptibility to infections and other complications (Choi & Park, 2021; Tan et al., 2021).

Despite the established risks, there remains a gap in understanding the specific mechanisms by which diabetes influences surgical outcomes across different types of procedures. While some studies have focused on general surgical populations, others have concentrated on specific surgical fields, such as orthopedic and colorectal surgery. However, the variability in surgical types, patient demographics, and diabetes management strategies complicates the generalizability of findings. Furthermore, existing literature often lacks comprehensive analyses that account for the multifactorial nature of diabetes-related complications, such as the interplay between glycemic control, comorbidities, and surgical techniques (McDermott et al., 2023; Tan et al., 2021).

For instance, studies have shown that maintaining blood glucose levels within target ranges can significantly reduce the incidence of postoperative infections and other complications. However, the optimal strategies for achieving and maintaining glycemic control in the perioperative setting remain underexplored. Additionally, the impact of diabetes on long-term surgical outcomes, including the need for reoperation and overall survival, is not well-documented, highlighting a critical area for future research (Grammatica et al., 2019).

This study presents a systematic review of the outcomes of diabetic patients undergoing various surgical procedures, with the objective of addressing two critical research questions: This study aims to address two critical research questions: How does diabetes influence postoperative outcomes across different types of surgeries? What are the key factors contributing to variations in recovery and complication rates among diabetic patients?

The findings of this research provide valuable insights for healthcare professionals and

surgeons to develop targeted strategies for preoperative assessment, intraoperative management, and postoperative care. By understanding these outcomes, medical practitioners can enhance surgical success rates, minimize complications, and improve overall patient recovery, particularly in the context of the growing global prevalence of diabetes.

RESEARCH METHODOLOGY

In conducting this research, the systematic literature review (SLR) will serve as a critical tool for gathering, evaluating, and synthesising existing academic contributions, thereby providing a solid foundation for understanding the chosen topic and guiding future research directions.

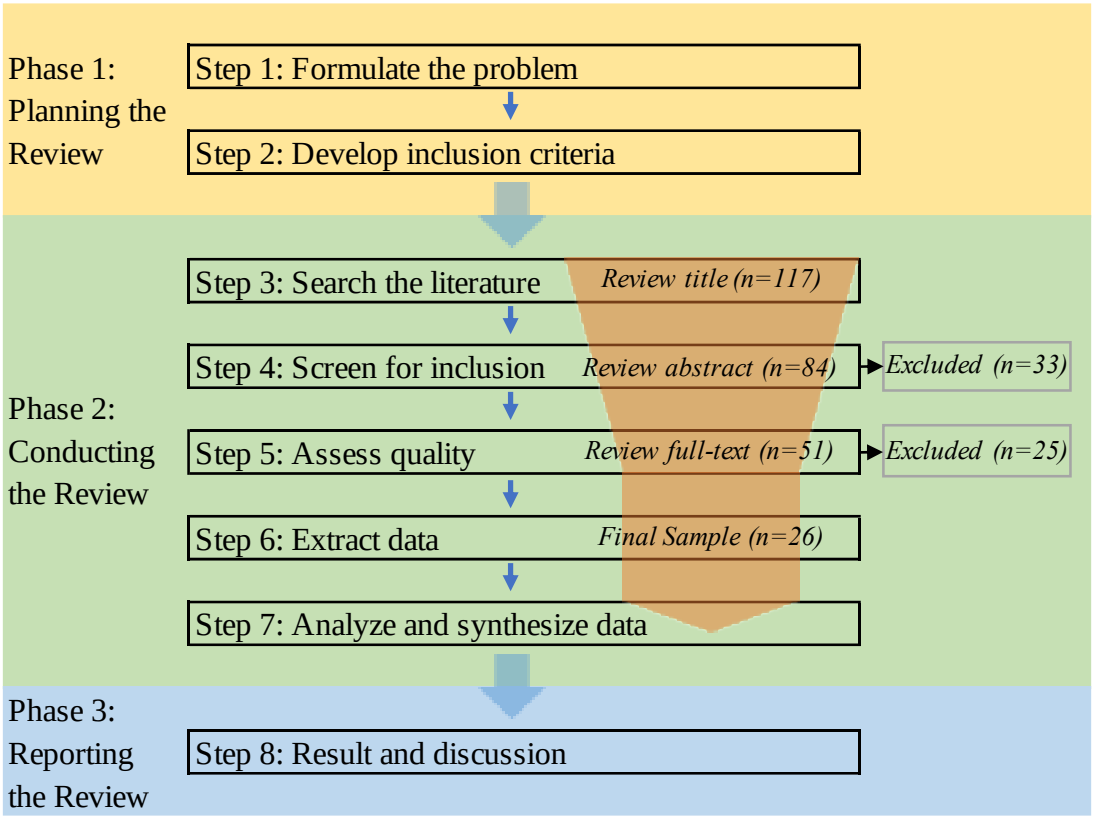

Figure 1. Process of systematic literature review *(Xiao & Watson, 2019)*

Phase One: Planning the Review. The planning phase commences with the definition of the research question. The objective is to identify the factors that influence the outcomes of diabetic patients undergoing surgical procedures. This question aims to elucidate the relationship between diabetes and surgical outcomes, with a particular focus on complications, recovery rates, and mortality. The subsequent stage is to establish the inclusion criteria, with a view to selecting studies that are both relevant and of a high quality.

In conducting this systematic review, data were sourced from a variety of databases, including PubMed, ScienceDirect, and Web of Science, with the aim of targeting publications from 2019 to 2024. The inclusion criteria were designed to prioritize specific keywords, including "Diabetes," "Surgical Outcomes," "Postoperative Complications," and "Patient Recovery." This approach ensured that the selected articles focused on diabetic patients and their surgical experiences.

Phase Two: Conducting the Review. This phase commences with a systematic search of the literature across the predefined databases, utilising the keywords and inclusion criteria established in the planning phase. The identification and initial screening of relevant studies was conducted based on their titles and abstracts. This was followed by a detailed review of the full texts. The selection process prioritized studies that employed robust methodologies and provided clear data reporting. A quality assessment was conducted to ensure the credibility of the studies selected for review, with particular emphasis placed on research that provided comprehensive data on the preoperative, intraoperative, and postoperative factors affecting diabetic patients. Only studies that met these rigorous criteria proceeded to the data extraction and synthesis stages.

Phase Three: Reporting the Findings. The final phase of the study involves the presentation of the synthesized findings in a structured and transparent manner. This includes the summarization of key outcomes, such as complication rates, recovery timelines, and mortality risks among diabetic patients undergoing surgery. Additionally, the results highlight critical preoperative and intraoperative factors, such as glycemic control and surgical type, alongside postoperative care strategies that improve patient outcomes. By clearly communicating these findings, this review provides actionable insights for clinicians and healthcare policymakers aiming to optimize surgical care for diabetic patients and reduce associated risks.

RESULT AND DUSCUTION

A. Increased Risk of Postoperative Complications

Diabetes significantly elevates the risk of surgical site infections (SSIs), wound dehiscence, and hospital readmissions, making preoperative glycemic control crucial. Lower preoperative HbA1c levels are associated with reduced complications, including SSIs, renal failure, and myocardial infarction. In ophthalmic surgeries, diabetic retinopathy worsens outcomes, leading to complications such as corneal edema and posterior capsular opacification (PCO), though these risks can be mitigated with effective glycemic control (Birch et al., 2021; Korkmaz et al., 2024; Misra et al., 2024; Philippi et al., 2022; Tan et al.,

2021; Ukon et al., 2023; J. Wang et al., 2019, 2020; Zhen Ling Teo et al., 2121).

B. Enhanced Recovery Pathways (ERAS)

Enhanced Recovery After Surgery (ERAS) protocols have been linked to notable clinical outcome improvements and cost savings across numerous surgical specialties. However, there are several opportunities and challenges that require further discussion. In particular, ERAS protocols have demonstrated effectiveness in reducing perioperative stress, stabilizing blood glucose levels, and improving outcomes in diabetic patients, particularly in gastric cancer surgeries (Ammar et al., 2021; Olle Ljungqvist et al., 2021; Suthar & Modi, 2021; J. Wang et al., 2019; P. Wang et al., 2022; Y. Wang et al., 2022).

C. Health Literacy and Self-Care

Health literacy plays a pivotal role in diabetes management, significantly influencing patients' diabetes knowledge and glycemic control. However, the correlation between self-care and health literacy varies based on the assessment approach, with performance-based measures often yielding different insights compared to perception-based evaluations (Dell'Isola et al., 2019; Gilmore et al., 2019; Marciano et al., 2019).

D. Impact of Proactive Glycemic Management

Proactive glycemic monitoring systems have demonstrated success in reducing hyperglycemia-related complications. For instance, targeted glucose control has been associated with a significant reduction in surgical site infection (SSI) rates. A meta-analysis revealed that intensive glucose control protocols reduced the odds of SSIs by 57% compared to conventional protocol. Implementing effective glycemic control measures requires overcoming barriers such as variability in clinical practices and the need for comprehensive staff training (Alfonso et al., 2019; Angelo-Khattar & Vadarli, 2021; de Vries et al., 2017; Dell'Isola et al., 2019; Kozyrakis et al., 2022; Luthra et al., 2022; Neelakandan et al., 2021; Titan et al., 2020).

DISCUSSION

Diabetes is a significant risk factor for postoperative complications, including surgical site infections (SSIs), wound dehiscence, and delayed recovery. This highlights the importance of effective preoperative glycemic control. The reduction of HbA1c levels and targeted management of complications related to diabetes, including retinopathy and neuropathy, are essential for the minimization of risks and the optimization of surgical

outcomes. The necessity for condition-focused strategies is further underscored by procedure-specific challenges, such as corneal edema in ophthalmic surgeries.

Enhanced Recovery After Surgery (ERAS) protocols are an effective framework for improving perioperative outcomes in diabetic patients. ERAS pathways have demonstrated success in surgeries like gastric cancer procedures by stabilizing glucose levels and reducing surgical stress. However, diabetes-specific adaptations and inconsistent adherence to protocols present challenges to their effectiveness. Similarly, health literacy plays a pivotal role in self-care and recovery. Diabetic patients must be empowered to better manage their condition and adhere to postoperative care instructions to reduce complications.

Proactive glycemic management systems, such as continuous glucose monitoring (CGM), demonstrably improve outcomes through real-time glucose control. Despite their proven effectiveness in reducing SSIs and other complications, adoption is limited by cost and logistical barriers. These challenges can be overcome by ensuring better adherence to standardized guidelines, comprehensive staff training, and system-wide integration of glycemic management practices. By combining preoperative optimization, ERAS protocols, patient education, and proactive monitoring, healthcare providers can achieve improved surgical outcomes and quality of care for diabetic patients.

CONCLUSTION

This study provides critical insights for healthcare professionals, especially surgeons, in improving preoperative, intraoperative, and postoperative strategies for diabetic patients. Effective glycemic control, Enhanced Recovery After Surgery (ERAS) protocols, and improved health literacy significantly enhance surgical outcomes, reduce complications, and accelerate recovery. Proactive glycemic management minimizes risks like surgical site infections while improving cost efficiency. This research advances existing knowledge by emphasizing integrated, multidisciplinary approaches to managing diabetes in surgical settings. Future studies should focus on developing personalized protocols based on surgery type and diabetes severity, as well as exploring advanced glycemic monitoring technologies in clinical practice.

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