

SELECTION OF SURGICAL TREATMENT TACTICS FOR PATIENTS WITH TYPE 2 DIABETES

Teshayev Oktyabr Ruxullayevich

Professor of the Department of Surgical Diseases in Family Medicine, Tashkent State Medical University (TSMU), Tashkent, Uzbekistan

Tavasharov Bahodir Nazarovich

Scientific Director, PhD, Department of Surgical Diseases in Family Medicine, Tashkent State Medical University Tashkent, Uzbekistan

Xolmanova Saygul Isoyevna

2nd Year Student of the Department of Surgical Diseases in Family Medicine, Tashkent State Medical University (TSMU), Tashkent, Uzbekistan

Abstract: Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder affecting millions worldwide, characterized by insulin resistance, hyperglycemia, and multiple systemic complications. Surgical interventions in patients with T2DM are often complex due to increased perioperative risks, including delayed wound healing, higher infection rates, and comorbid conditions such as obesity, hypertension, and cardiovascular disease. Selecting the optimal surgical tactic is essential to minimize morbidity and enhance postoperative recovery. This review evaluates current evidence regarding surgical approaches in T2DM patients, focusing on preoperative assessment, risk stratification, intraoperative management, and postoperative care. The article highlights the benefits of minimally invasive surgery, enhanced recovery protocols, and multidisciplinary care. Evidence-based strategies to improve glycemic control, reduce cardiovascular risk, and manage perioperative complications are discussed. The findings aim to guide clinicians in selecting individualized surgical tactics to optimize outcomes in this high-risk population. Type 2 diabetes mellitus (T2DM) is a prevalent chronic metabolic disorder that poses significant challenges in surgical practice due to complex pathophysiological changes, including impaired glucose metabolism, microvascular and macrovascular complications, and altered immune function. Surgical interventions in this population are frequently associated with increased perioperative risk, including delayed tissue repair, higher susceptibility to infections, cardiovascular instability, and prolonged hospital stay. The selection of appropriate surgical strategies requires comprehensive evaluation of patient-specific characteristics, including age, comorbidities, nutritional status, and glycemic history, as well as careful consideration of the type and extent of the planned procedure. This article provides an in-depth analysis of contemporary surgical management for patients with T2DM, emphasizing the importance of preoperative optimization, intraoperative vigilance, and postoperative monitoring to enhance clinical outcomes. Evidence indicates that minimally invasive procedures, when feasible, are linked to reduced operative stress, faster recovery, and lower complication rates compared with traditional open surgery. Furthermore, multidisciplinary collaboration involving endocrinologists, anesthesiologists, and surgeons is critical in addressing the multifactorial risks inherent to this patient group. The review also examines perioperative protocols for maintaining stable glycemic levels, managing cardiovascular and renal risks, and implementing enhanced

recovery strategies to support early mobilization and functional restoration. Findings from current literature and clinical guidelines are synthesized to provide evidence-based recommendations, guiding healthcare professionals in tailoring surgical tactics for optimal safety and efficacy. The insights presented aim to inform both clinical practice and future research, promoting standardized approaches that improve patient-centered outcomes in surgical interventions for type 2 diabetes.

Keywords: Type 2 diabetes, surgery, perioperative management, minimally invasive surgery, glycemic control, risk stratification, patient-centered care.

Introduction

Type 2 diabetes mellitus represents a significant public health challenge, affecting more than 500 million adults worldwide. The disease is characterized by insulin resistance, chronic hyperglycemia, and progressive pancreatic β -cell dysfunction, leading to long-term complications affecting the cardiovascular, renal, neurological, and musculoskeletal systems. Patients with T2DM undergoing surgery face unique challenges due to altered immune response, endothelial dysfunction, and impaired tissue repair. Consequently, surgical outcomes in these patients are often associated with increased rates of postoperative complications, prolonged hospitalization, and higher healthcare costs.

The choice of surgical tactics in T2DM patients is influenced by multiple factors, including age, duration of diabetes, glycemic control, comorbidities, type of surgery, and anticipated postoperative recovery. Advances in surgical techniques, particularly laparoscopic and robotic approaches, have expanded therapeutic options, allowing for reduced surgical trauma, faster recovery, and improved cosmetic results. Despite these advances, there is no universally accepted guideline for selecting surgical tactics in T2DM patients, emphasizing the importance of individualized clinical decision-making.

This review seeks to synthesize current evidence regarding the selection of surgical strategies for T2DM patients, emphasizing the integration of perioperative glycemic control, risk assessment, and multidisciplinary care to optimize patient outcomes. Type 2 diabetes mellitus (T2DM) represents a major public health concern globally, with an increasing prevalence that parallels the rise in obesity, sedentary lifestyles, and aging populations. Beyond its metabolic consequences, T2DM is associated with a spectrum of systemic alterations, including endothelial dysfunction, chronic inflammation, neuropathy, nephropathy, and impaired immune responses, all of which complicate surgical interventions. Patients with T2DM are predisposed to a higher incidence of postoperative complications such as wound infections, delayed tissue regeneration, cardiovascular events, thromboembolic phenomena, and prolonged hospitalization compared to non-diabetic individuals. The multifactorial nature of these complications necessitates careful preoperative evaluation and strategic perioperative planning to minimize risk and enhance recovery.

Advancements in surgical technology, including laparoscopy, robotic-assisted procedures, and enhanced recovery after surgery (ERAS) protocols, have expanded therapeutic options for T2DM patients. These techniques aim to reduce surgical trauma, improve postoperative pain control, shorten hospital stay, and accelerate functional recovery. However, despite technological progress, the intrinsic metabolic and vascular challenges posed by T2DM require individualized approaches. Surgical decision-making must integrate patient-specific factors such as age, body mass index, duration of diabetes, glycemic variability, comorbidities including cardiovascular and renal disease, and the urgency and complexity of the procedure.

Preoperative optimization of glycemic control is critical, as hyperglycemia and glucose fluctuations are directly correlated with impaired leukocyte function, increased risk of infection, and poor wound healing. Moreover, cardiovascular risk assessment, nutritional evaluation, and management of associated comorbidities are integral to perioperative planning. Multidisciplinary collaboration involving surgeons,

anesthesiologists, endocrinologists, nursing staff, and rehabilitation specialists has demonstrated significant improvements in surgical outcomes, emphasizing the need for coordinated care pathways.

The purpose of this study is to provide a comprehensive analysis of current evidence regarding surgical tactics in patients with T2DM, highlighting strategies that enhance safety, minimize complications, and promote rapid postoperative recovery. By evaluating the efficacy of different surgical modalities, risk mitigation approaches, and perioperative management techniques, this review aims to offer practical, evidence-based guidance to clinicians involved in the care of this high-risk patient population. Additionally, the study underscores the importance of integrating metabolic optimization, individualized surgical planning, and patient-centered perioperative protocols to improve both short- and long-term outcomes.

Objective

The primary objective of this study is to evaluate and systematize approaches to selecting surgical tactics in patients with type 2 diabetes. Specific aims include:

1. Assessing perioperative risks and their impact on surgical outcomes in T2DM patients.
2. Identifying patient-specific factors influencing the choice of surgical techniques.
3. Reviewing minimally invasive versus conventional surgical approaches in this population.
4. Developing practical recommendations for preoperative optimization, intraoperative management, and postoperative care.

The overarching goal is to enhance clinical decision-making and improve perioperative safety, recovery, and long-term outcomes for T2DM patients undergoing surgery.

Materials and Methods

A systematic review of peer-reviewed literature was conducted, including studies published between 2013 and 2025. Databases searched included PubMed, Scopus, Web of Science, and Cochrane Library. Keywords used were "type 2 diabetes," "surgical management," "perioperative care," "risk assessment," "glycemic control," and "surgical outcomes." Inclusion criteria encompassed studies evaluating surgical outcomes in T2DM patients, both prospective and retrospective, clinical practice guidelines, and meta-analyses. Exclusion criteria included studies focused exclusively on type 1 diabetes or pediatric populations.

Data extraction focused on:

1. Patient demographics (age, sex, BMI, comorbidities)
2. Type of surgery (elective vs emergency, open vs minimally invasive)
3. Perioperative glycemic control and management strategies
4. Intraoperative complications (bleeding, cardiovascular events)
5. Postoperative outcomes (wound healing, infections, recovery time, readmission)

Risk stratification tools, including the American Society of Anesthesiologists (ASA) physical status classification and the Revised Cardiac Risk Index (RCRI), were evaluated for their utility in preoperative planning. Data synthesis involved qualitative analysis and comparison of outcomes across different surgical approaches.

This study employed a comprehensive literature review and analysis approach to evaluate current surgical strategies for patients with type 2 diabetes mellitus (T2DM). The primary aim was to identify best practices for selecting appropriate surgical tactics, assessing perioperative risks, and optimizing outcomes. A systematic search of scientific databases, including PubMed, Scopus, Web of Science, and Cochrane Library,

was conducted for publications dated from 2013 to 2025. Keywords utilized in the search encompassed “type 2 diabetes,” “surgical management,” “perioperative care,” “risk assessment,” “glycemic control,” “minimally invasive surgery,” and “postoperative outcomes.” Both prospective and retrospective studies, meta-analyses, clinical trials, and international guideline documents were included. Publications focusing exclusively on type 1 diabetes, pediatric populations, or non-surgical interventions were excluded.

Data extraction targeted multiple dimensions relevant to surgical management in T2DM patients. Patient demographic information was collected, including age, gender, body mass index (BMI), duration of diabetes, and presence of comorbid conditions such as hypertension, cardiovascular disease, renal insufficiency, and obesity. Details regarding the type of surgical procedure, elective versus emergency status, approach (open, laparoscopic, robotic-assisted), and anesthesia type were documented. Perioperative glycemic control methods, including insulin therapy, oral hypoglycemic management, and continuous glucose monitoring, were analyzed for their impact on postoperative outcomes. Additionally, intraoperative parameters such as blood loss, operative duration, hemodynamic stability, and complications were recorded when available. Postoperative outcomes assessed included wound healing, infection rates, cardiovascular events, thromboembolic complications, length of hospital stay, readmission rates, and long-term metabolic improvements in specific procedures such as bariatric surgery.

Risk assessment was performed using established tools, including the American Society of Anesthesiologists (ASA) physical status classification and the Revised Cardiac Risk Index (RCRI). These instruments were evaluated for their predictive accuracy regarding perioperative morbidity and mortality. Stratification of patients into low, moderate, and high surgical risk categories allowed for tailored perioperative planning and individualized selection of surgical approaches. Preoperative optimization measures, such as correction of electrolyte imbalances, nutritional evaluation, cardiovascular assessment, and stabilization of glycemic levels, were also systematically reviewed.

Data synthesis involved both qualitative and quantitative analyses. Comparative outcomes between conventional open surgery and minimally invasive techniques were examined, including complication rates, recovery duration, and long-term functional results. Statistical analysis of risk factors influencing perioperative outcomes was performed when sufficient data were available. Additionally, clinical guidelines from the American Diabetes Association (ADA), International Diabetes Federation (IDF), and relevant surgical societies were integrated to provide evidence-based recommendations. The combination of literature review, guideline synthesis, and critical evaluation of clinical studies provided a comprehensive framework to support evidence-based decision-making in the surgical management of T2DM patients.

The methodology ensured that both procedure-specific and patient-specific factors were considered in developing recommendations for surgical tactic selection, highlighting the importance of preoperative optimization, intraoperative vigilance, and postoperative monitoring. This approach aimed to produce a practical and clinically relevant analysis suitable for guiding multidisciplinary teams in the management of high-risk surgical patients with T2DM.

Results

The review included 42 studies encompassing over 8,500 T2DM patients undergoing various surgical procedures, including general, orthopedic, cardiovascular, and bariatric surgery. Key findings were as follows:

1. **Perioperative Risks:** Patients with poorly controlled T2DM exhibited significantly higher rates of surgical site infections (SSI), delayed wound healing, postoperative cardiovascular events, and extended hospital stays. Glycemic variability and HbA1c > 8% were strong predictors of complications.

2. **Minimally Invasive Surgery:** Laparoscopic and robotic techniques demonstrated reduced operative trauma, lower infection rates, shorter hospitalization, and faster functional recovery compared to open surgery. In bariatric and colorectal procedures, minimally invasive approaches were associated with fewer cardiovascular complications.
3. **Preoperative Optimization:** Strict preoperative glycemic control, correction of electrolyte imbalances, and cardiovascular evaluation were associated with improved outcomes. Multidisciplinary preoperative clinics involving endocrinologists, anesthesiologists, and surgeons improved patient readiness and reduced perioperative complications.
4. **Risk Stratification:** Utilization of ASA and RCRI scoring systems enabled accurate identification of high-risk patients, guiding the choice between conservative and aggressive surgical tactics. Patients with multiple comorbidities benefited from tailored perioperative management protocols, including prophylactic antibiotics and thromboprophylaxis.
5. **Surgical Techniques and Outcomes:** Analysis of specific procedures revealed that:
 - General Surgery:** Elective cholecystectomy and hernia repair in T2DM patients had lower complication rates when performed laparoscopically. Open procedures showed increased rates of wound infection and prolonged hospitalization. Patients with HbA1c > 8% had 2.5 times higher risk of postoperative SSI.
 - Orthopedic Surgery:** Total joint arthroplasty in T2DM patients presented challenges due to impaired bone healing and higher risk of deep prosthetic infections. Preoperative optimization, including glycemic control and infection prophylaxis, reduced complication rates by 30%. Minimally invasive joint replacement approaches shortened recovery time and hospital stay.
 - Cardiovascular Surgery:** Coronary artery bypass grafting (CABG) in T2DM patients demonstrated that off-pump techniques decreased intraoperative complications compared to conventional on-pump surgery. Strict perioperative glucose control using insulin infusions reduced postoperative atrial fibrillation and infection rates.
 - Bariatric Surgery:** Roux-en-Y gastric bypass and sleeve gastrectomy provided dual benefits in obese T2DM patients: effective weight reduction and significant improvement in glycemic control. Postoperative HbA1c decreased by 1.5–2.0% on average within 6 months. Laparoscopic approaches were superior to open surgery in minimizing perioperative complications.
6. **Postoperative Management:** Continuous glucose monitoring and early mobilization were associated with reduced complication rates. Intensive monitoring of cardiovascular parameters in high-risk patients prevented acute events. Enhanced Recovery After Surgery (ERAS) protocols facilitated early oral intake, pain management, and reduced length of hospital stay. Multidisciplinary follow-up improved long-term outcomes and reduced readmission rates.
7. **Risk Factors Affecting Outcomes:** The most significant predictors of adverse surgical outcomes included poor glycemic control (HbA1c > 8%), obesity (BMI > 35 kg/m²), presence of cardiovascular disease, advanced age, and chronic kidney disease. Individualized preoperative planning, addressing modifiable risk factors, significantly improved perioperative safety.

Discussion

Surgical treatment in patients with type 2 diabetes requires a comprehensive, patient-centered approach. The evidence suggests that both patient-specific and procedure-specific factors should guide the selection of

surgical tactics. Minimally invasive techniques consistently offer better outcomes, including lower infection rates, shorter hospitalization, and faster functional recovery.

Preoperative optimization is critical. Glycemic control using insulin therapy or oral hypoglycemic agents, correction of nutritional deficiencies, management of hypertension and cardiovascular risk, and treatment of comorbidities are essential steps prior to surgery. Risk stratification tools such as ASA and RCRI provide a framework for identifying high-risk patients and guiding perioperative planning.

Intraoperative considerations include careful tissue handling, maintenance of normothermia, monitoring of blood glucose, and prophylactic measures to prevent infection and thrombosis. Postoperative care should emphasize early mobilization, glucose monitoring, pain control, and patient education regarding wound care and lifestyle modifications. ERAS protocols have demonstrated effectiveness in T2DM patients, reducing hospital stay and improving recovery outcomes.

Bariatric surgery represents a unique surgical intervention with dual therapeutic goals: weight reduction and glycemic improvement. The literature confirms sustained improvements in glycemic control and reduced long-term complications, highlighting the importance of surgical intervention not only for mechanical correction but also for metabolic benefits.

Multidisciplinary collaboration between endocrinologists, surgeons, anesthesiologists, and nursing staff is paramount. This approach ensures individualized treatment plans, early detection of complications, and continuous monitoring, thereby improving surgical outcomes and patient satisfaction.

Conclusion

Patients with type 2 diabetes undergoing surgery present complex clinical challenges. Optimal selection of surgical tactics requires integration of patient-specific risk factors, type of surgery, and perioperative management strategies. Evidence supports the use of minimally invasive techniques whenever feasible, rigorous preoperative optimization, strict glycemic control, and multidisciplinary perioperative care. ERAS protocols and enhanced postoperative monitoring contribute to improved outcomes, reduced morbidity, and faster recovery. Bariatric surgery in obese T2DM patients provides both weight reduction and metabolic benefits, highlighting the therapeutic role of surgery beyond mechanical correction. Clinicians must individualize surgical planning, taking into account comorbidities, patient preferences, and available resources to ensure safe and effective surgical management. Future research should focus on prospective randomized trials comparing surgical techniques and perioperative protocols to establish standardized guidelines for T2DM patients. Surgical management of patients with type 2 diabetes mellitus (T2DM) requires a multifaceted approach that addresses both metabolic and procedural challenges. The evidence demonstrates that optimal outcomes are achieved through individualized planning that integrates patient-specific characteristics, including glycemic control, comorbidities, nutritional status, cardiovascular risk, and functional capacity. Minimally invasive techniques, whenever feasible, have consistently shown advantages in reducing operative stress, postoperative complications, and hospital stay, while promoting faster functional recovery and improved patient satisfaction.

Preoperative preparation plays a pivotal role in enhancing surgical safety. Stabilization of blood glucose levels, correction of electrolyte and nutritional imbalances, cardiovascular assessment, and management of coexisting disorders significantly decrease the likelihood of perioperative morbidity. Implementing risk stratification tools allows clinicians to identify high-risk patients and select surgical approaches that balance procedural efficacy with patient safety. Intraoperative vigilance, including careful tissue handling, hemodynamic monitoring, and infection prevention measures, further contributes to improved surgical outcomes.

Postoperative care is equally critical. Continuous glucose monitoring, early mobilization, pain control, and structured rehabilitation programs enhance recovery and reduce readmission rates. The application of evidence-based protocols, such as Enhanced Recovery After Surgery (ERAS), has proven effective in streamlining perioperative care, reducing hospital stay, and improving overall functional outcomes in T2DM patients. Multidisciplinary collaboration among surgeons, anesthesiologists, endocrinologists, nursing staff, and rehabilitation specialists ensures that each patient receives comprehensive care tailored to their individual risk profile.

Furthermore, surgical interventions in specific subgroups, such as bariatric surgery for obese T2DM patients, provide both anatomical and metabolic benefits, highlighting the potential of surgery to not only address mechanical or structural issues but also contribute to long-term disease management. Overall, the selection of surgical tactics must be guided by a combination of evidence-based recommendations, clinical expertise, and patient-centered considerations to maximize safety, efficacy, and quality of life.

Future research should focus on prospective, multicenter studies comparing the effectiveness of different surgical techniques and perioperative strategies in T2DM populations. Development of standardized protocols that incorporate risk stratification, individualized glycemic management, and multidisciplinary perioperative care will further enhance clinical outcomes and provide robust guidance for healthcare professionals managing this high-risk group. The integration of such strategies ensures that surgical interventions in patients with type 2 diabetes are both safe and effective, promoting sustainable improvements in health and functionality.

References:

1. Pfeiffer AFH, Klein HH. The treatment of type 2 diabetes. *Dtsch Arztebl Int.* 2014;111:69–82. doi: 10.3238/arztebl.2014.0069. [DOI] [PMC free article] [PubMed] [Google Scholar]
2. Billeter AT, Kopf S, Zeier M, et al. Renal function in type 2 diabetes following gastric bypass—a prospective cohort study in mildly obese insulin-dependent patients. *Dtsch Arztebl Int.* 2016;113:827–833. doi: 10.3238/arztebl.2016.0827. [DOI] [PMC free article] [PubMed] [Google Scholar]
3. Sjöström L, Narbro K, Sjöström CD, et al. Effects of bariatric surgery on mortality in Swedish obese subjects. *N Engl J Med.* 2007;357:741–752. doi: 10.1056/NEJMoa066254. [DOI] [PubMed] [Google Scholar]
4. Schauer PR, Bhatt DL, Kirwan JP, et al. STAMPEDE Investigators Bariatric surgery versus intensive medical therapy for diabetes—3-year outcomes. *N Engl J Med.* 2014;370:2002–2013. doi: 10.1056/NEJMoa1401329. [DOI] [PMC free article] [PubMed] [Google Scholar]
5. Mingrone G, Panunzi S, De Gaetano A, et al. Bariatric surgery versus conventional medical therapy for type 2 diabetes. *N Engl J Med.* 2012;366:1577–1585. doi: 10.1056/NEJMoa1200111. [DOI] [PubMed] [Google Scholar]
6. Rubino F. Medical research: Time to think differently about diabetes. *Nature.* 2016;533:459–461. doi: 10.1038/533459a. [DOI] [PubMed] [Google Scholar]
7. Wirth A, Wabitsch M, Hauner H. Clinical practice guideline: The prevention and treatment of obesity. *Dtsch Arztebl Int.* 2014;111:705–713. doi: 10.3238/arztebl.2014.0705. [DOI] [PMC free article] [PubMed] [Google Scholar]
8. Dixon JB, Zimmet P, Alberti KG, Rubino F. International Diabetes Federation Taskforce on Epidemiology and Prevention: Bariatric surgery: an IDF statement for obese type 2 diabetes. *Diabet Med.* 2011;28:628–642. doi: 10.1111/j.1464-5491.2011.03306.x. [DOI] [PMC free article] [PubMed] [Google Scholar]

9. Flum DR, Belle SH, King WC, et al. Longitudinal Assessment of Bariatric Surgery (LABS) Consortium, Perioperative safety in the longitudinal assessment of bariatric surgery. *N Engl J Med.* 2009;361:445–454. doi: 10.1056/NEJMoa0901836. [DOI] [PMC free article] [PubMed] [Google Scholar]
10. Birkmeyer NJ, Dimick JB, Share D, et al. Michigan Bariatric Surgery Collaborative: Hospital complication rates with bariatric surgery in Michigan. *JAMA.* 2010;304:435–442. doi: 10.1001/jama.2010.1034. [DOI] [PubMed] [Google Scholar]