REVIEW

European Archives of Medical Research

DOI: 10.14744/eamr.2025.45762
Eur Arch Med Res 2025;41(3):125–130

Perioperative Management of Hyperglycemia and Hypoglycemia

Mehmet Sahap,[1] Beyza Nur Coban,[2] Ikbal Efnan Asik,[2] Handan Gulec,[1] Ezgi Erkilic[3]

[1]Department of Anesthesia and Resuscitation, Yildirim Beyazit University, Faculty of Medicine, Ankara Bilkent City Hospital, Ankara, Türkiye
[2]Department of Anesthesia and Resuscitation, Ankara Bilkent City Hospital, Ankara, Türkiye
[3]Department of Anesthesia and Resuscitation, Ankara City Hospital, University of Health Sciences, Ankara, Türkiye

ABSTRACT

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from inadequate insulin secretion or impaired insulin action, leading to disturb-ances in carbohydrate, fat, and protein metabolism. In recent years, the prevalence of diabe-tes in Türkiye has significantly increased, posing a major public health concern and under-scoring the need for early diagnosis and effective perioperative management. In the pre-operative period, diabetic patients require thorough evaluation to identify comorbidities, optimize glycemic control, and reduce the risk of perioperative complications. Key anesthet-ic considerations include assessing cardiovascular and renal status, evaluating for autonom-ic neuropathy, and determining the presence of delayed gastric emptying, which may influ-ence airway management. Pre-operative optimization involves maintaining blood glucose within the recommended target range, adjusting or withholding oral hypoglycemic agents, and transitioning to intravenous insulin infusion if necessary. This review focuses on the principles of anesthesia management in diabetic patients, emphasizing pre-operative as-sessment, intraoperative glycemic control, and post-operative monitoring to improve surgi-cal outcomes.

Keywords: Diabetes mellitus, Hyperglycemia, Hypoglycemia, Surgery

Cite this article as: Sahap M, Coban BN, Asik IE, Gulec H, Erkilic E. Perioperative Management of Hyperglycemia and Hypoglycemia. Eur Arch Med Res 2025;41(3):125–130.

INTRODUCTION

Diabetes mellitus (DM) is defined by the Turkish Society of Endocrinology and Metabolism as a metabolic disorder characterized by chronic hyperglycemia due to inadequate insulin secretion or impaired insulin action. This condition causes various abnormalities in carbohydrate, fat, and protein metabolism.[1]

In recent years, the prevalence of diabetes in Türkiye has shown a significant increase. This has become a serious public health concern and emphasizes the need for early diagnosis and effective management strategies.

According to the results of the Turkish Diabetes, Hypertension, and Obesity Prevalence Study (TURDEP)-I conducted in 1997–1998, the prevalence of diabetes among individuals aged 20 years and older was found to be 7.2%.[2]

Twelve years later, the TURDEP-II, conducted in the same centers and among similar age groups, reported a prevalence rate of 13.7%.[3]

Address for correspondence: Mehmet Sahap, Department of Anesthesia and Resuscitation, Yildirim Beyazit University, Faculty of Medicine, Ankara Bilkent City Hospital, Ankara, Türkiye

E-mail: drsahap@gmail.com **ORCID ID:** 0000-0003-3390-9336

Submitted: 08.07.2025 **Revised:** 11.08.2025 **Accepted:** 12.08.2025 **Available Online:** 12.09.2025

European Archives of Medical Research – Available online at www.eurarchmedres.org

The difference between these two studies indicates that the prevalence of diabetes in Türkiye has nearly doubled, imposing a significant burden on public health. This increase is associated with factors such as lifestyle changes, urbanization, rising rates of obesity, and physical inactivity.

A similar situation is observed in the United States, where the prevalence of DM has significantly increased in recent years. According to national health surveys conducted in 1999–2000, the prevalence of diabetes among adults in the U.S. was reported to be 9.7%. However, recent evaluations conducted between August 2021, and August 2023, indicate that this figure has risen to 14.3%.[4]

Diabetes is often diagnosed during pre-operative assessments. The American Diabetes Association recommends screening all overweight individuals with an additional risk factor for diabetes.

It has been reported that approximately 30–40% of patients undergoing cardiac surgery have a history of diabetes. Furthermore, in individuals without a prior diagnosis, stress hyperglycemia – defined as a blood glucose (BG) level exceeding 140 mg/dL – may devel-op in up to 60% of cases.[5]

Various studies have demonstrated that perioperative hyperglycemia, whether in critically ill patients or those undergoing cardiac surgery, increases morbidity and mortality rates. Regardless of a prior diabetes diagnosis, patients with perioperative hyperglycemia are associ-ated with higher rates of wound infections; development of acute kidney injury, prolonged hospital stays, and increased risk of perioperative mortality.[6]

Stress hyperglycemia that develops in individuals without a diagnosis of diabetes, particularly those undergoing coronary artery bypass graft surgery or being monitored in the intensive care unit, is associated with worse clinical outcomes than in individuals with known diabetes. In these patients, the complication rate has been found to be four times higher, and the mortality rate twice as high, compared to normoglycemic patients.[7]

The development of stress hyperglycemia involves several mechanisms, including stress hormones (cortisol, adrenaline), proinflammatory cytokines, and disruption of insulin secretion and action mediated by the central nervous system. This leads to increased glucose production in the liver and reduced glucose uptake in peripheral tissues.[8]

The adverse outcomes of hyperglycemia are explained by mechanisms such as inflammation, oxidative stress, prothrombotic activity, and vascular dysfunction.[9]

Long-term follow-up of patients who develop stress hyperglycemia is of great importance. It has been reported that approximately 60% of these individuals are diagnosed with diabe-tes within 1 year.[10]

The effects of different types of anesthesia on intraoperative glucose control were evaluated in a systematic review and meta-analysis conducted by Li et al.[11] in 2017. According to this study published in Medicine, combined general-epidural anesthesia was found to be more effective in controlling intraoperative glucose levels compared to general anesthesia alone. However, no significant difference was observed between isolated epidural anesthe-sia and general anesthesia.

Pre-Operative Assessment

The pre-operative assessment of diabetic patients is critically important for the successful management of the surgical process (Fig. 1). The following steps constitute the core com-ponents of this evaluation:

- A detailed medical history and physical examination should be conducted. The type and duration of diabetes, current medications, and the presence of diabetes-related organ damage must be assessed[12]
- Glycemic control status should be determined through tests such as hemoglobin A1c (HbA1c) and BG measurements. These tests play a significant role in shaping perioperative glycemic management strategies[13]
- Liver and renal functions should be evaluated, as diabetic patients often experience impairments in kidney and liver function[14]

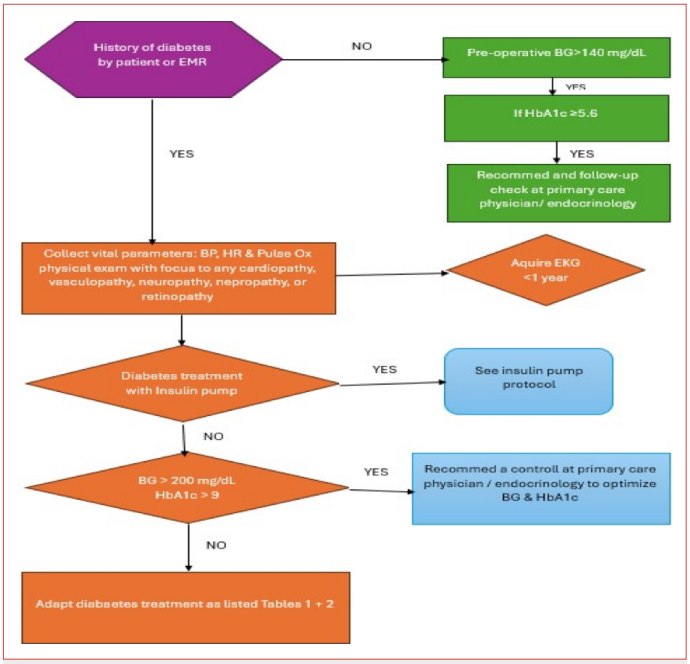

Figure 1. Pre-operative diabetes screening and management algorithm.

Table 1. Perioperative effects of oral antidiabetic agents

OAD class	Examples	Warnings/Precautions
Secretagogues (Sulfonylureas, etc.,)	Gliburide Glimepiride	Risk of hypoglycemia, prolonged drug effect, and challenges in dose titration.
Biguanides	Metformin	Risk of lactic acidosis; use with caution in renal and hepatic impairment
Thiazolidinediones	Rosiglitazone	Intravascular volume expansion, delayed onset of action, and challenges in dose titration

OAD: Oral Anti Diabetic.

- Electrolyte balance and ECG evaluations should be performed, especially consider-ing the effects of hyperglycemia on cardiac rhythm.[15]

ORAL ANTIDIABETICS

Oral antidiabetic therapy plays an important role in the management of diabetes and consists of various pharmacological classes (Table 1). These drugs aim to control BG by either en-hancing insulin effects or inhibiting glucose production.

- **Sulfonylureas** increase insulin secretion by blocking potassium channels in pan-creatic beta cells. These drugs generally reduce HbA1c by approximately 1–2%.[16] This group of drugs is commonly used in diabetes treatment and is particularly ef-fective in patients with moderate hyperglycemia
- **Metformin** increases insulin sensitivity in tissues and reduces hepatic gluconeogenesis. Metformin effectively lowers hyperglycemia by about 25% in 90% of patients.[17] In addition, the cardiovascular benefits of metformin represent a significant advantage, making it the first-line therapy for most diabetic patients
- **Thiazolidinediones** regulate glucose metabolism by increasing insulin sensitivity. These drugs are generally recommended for obese patients and those with devel-oped insulin resistance[18]
- **Meglitinides** accelerate insulin release from pancreatic beta cells and are typically administered before meals. These drugs help prevent rapid post-prandial glucose spikes[19]
- **Alpha-glucosidase inhibitors** delay the absorption of carbohydrates in the intestines, thereby controlling post-prandial hyperglycemia. These agents are particularly used in patients with rapid BG increases after meals[20]
- **Glucagon-like peptide-1 agonists** increase insulin secretion, inhibit glucagon release, and delay gastric emptying. Moreover, they reduce hunger sensation, sup-porting weight loss and weight management[21]
- **Sodium-glucose cotransporter 2 (SGLT2) inhibitors** inhibit glucose reabsorption in the kidneys, promoting excretion of excess glucose through urine. These drugs not only control hyperglycemia but also offer cardiovascular benefits.[22]

In a randomized controlled trial, the hypothesis that continuation of oral antidiabetic drugs (OADs) before surgery would reduce perioperative BG levels was tested. The study compared two groups: one in which pre-operative OAD use was continued, and another in which OADs were discontinued. The group in which OADs were discontinued had an average BG level of 156 mg/dL (95% confidence interval: 146–167 mg/dL; $p<0.001$), while BG levels in the group continuing OADs were significantly lower (mean: 138 mg/dL; 95% confidence interval: 130–146 mg/dL).[23]

This result demonstrates that continuation of OADs pre-operatively has a beneficial effect on perioperative BG management.

Furthermore, it is emphasized that in patients using insulin, home insulin regimens and fasting glucose measurements must be carefully reviewed. Optimization of insulin therapy plays an important role in achieving BG control during the perioperative period.

Preoperatively, long-acting insulins are less likely to result in hypoglycemia and should therefore not be withheld. Half the normal dose of intermediate insulin should be taken on the day of surgery. Rapid-acting insulin should be withheld in patients with a BG below 200 mg/dL and carefully titrated in patients with a BG exceeding 200 mg/dL. General guidelines for insulin are summarized in Table 2.[24]

Management of Diabetic Patients in The Perioperative Period: Clinical Protocol Recommendations

To ensure the safe and effective management of surgical procedures in diabetic patients, each healthcare institution should establish its own clinical protocol. These protocols should cover the pre-operative and intraoperative periods to optimize patients' metabolic status.

In the pre-operative period, HbA1c and BG levels should be evaluated at least 3–4 days before the scheduled surgery. In elective surgeries, if BG exceeds 250 mg/dL, the procedure should be postponed.[1,25] Surgeries should preferably be scheduled in the early morning hours, considering the patient

Table 2. Insulin treatment on the day of surgery

Insulin types	Regiment on the day of surgery
Lantus/toujeo, tresiba, levemir (long-acting insulins)	Half dose of normal in the morning of surgery
Nph insulin (intermediate insulin)	Half dose of normal in the morning of surgery
Insulin aspart protamine, insulin aspart, insulin lispro protamine, insulin lispro, insulin neutral protamine hagedorn, and insulin regular (all mixed insulin)	Depending to the blood glucose: if >200 mg/dL: Take half dose of normal in the morning. If <200 mg/dL: no insulin
All models of insulin pumps: Endocrinology consult recommended expect patient's ambulatory	Basel rate until operation, continue with IV insulin during surgery

will not be able to eat breakfast. To prevent catabolic response and dehydration due to fasting, the use of carbohydrate-containing clear fluids or glucose gels is recommended.[26]

During intraoperative evaluation, rapid sequence intubation should be performed in diabetic patients with a high risk of difficult airway, particularly those suspected of gastroparesis, to reduce the risk of aspiration. Electrolyte disturbances, which are frequently encountered, should be carefully monitored. The target intraoperative BG range is 120–180 mg/dL, and continuous glucose monitoring (CGM) is essential to prevent both hypo- and hyperglycemic episodes.[1,26,27]

Use ff CGM in The Perioperative Period

CGMs, which are minimally invasive and measure interstitial glucose levels every 1–5 minutes, are widely used in daily diabetes management. However, these devices have not yet been officially approved for use in the perioperative setting.[28]

Physiological and technical factors during surgery, such as hypotension, hypothermia, hypoxia, and electrical interference, may compromise the accuracy of CGM readings. Therefore, CGM data should not be fully relied upon intraoperatively, and plasma glucose levels should be confirmed with standard methods when necessary.[25,29]

According to the updated 2023 guideline titled "*Guideline for Perioperative Care for People with Diabetes Mellitus Undergoing Elective and Emergency Surgery*," several key rec-ommendations have been provided for perioperative diabetes management. The guideline emphasizes avoiding prolonged pre-operative fasting and scheduling diabetic patients for surgery in the early morning. The recommended target BG range is 6–10 mmol/L (108–180 mg/dL), with values up to 12 mmol/L (216 mg/dL) considered acceptable. If BG falls be-low 70 mg/dL, intravenous glucose administration is advised.[30]

The new guideline offers detailed guidance on topics such as the management of patients using continuous subcutaneous insulin infusion (CSII), the risk of diabetic ketoacidosis with SGLT-2 inhibitors, and intervention protocols for impending hypoglycemia (4–6 mmol/L) and clinically significant hypoglycemia (<4 mmol/L). It also provides comprehensive recommendations for adjusting insulin and other antidiabetic medications in the pre- and post-operative periods. The 2023 edition is more detailed than its 2021 predecessor and aims to reduce surgical complications.[30]

Perioperative Hyperglycemia and Insulin Management

Perioperative BG levels exceeding 180 mg/dL are associated with increased morbidity, par-ticularly infection risk, and higher mortality. Therefore, insulin therapy should be initiated, aiming to maintain BG within the range of 140–180 mg/dL. Tight glycemic control target-ing normoglycemia increases the risk of severe hypoglycemia and has not demonstrated additional benefit. In patients with Type 1 or Type 2 diabetes, or those with stress-induced hyperglycemia, transition to continuous intravenous insulin infusion (IVCSII) is recom-mended when a personal insulin pump is discontinued. This strategy is particularly preferred for prolonged surgeries and in critically ill patients.[31]

For nausea and vomiting prophylaxis, the use of 4 mg dexamethasone in combination with another antiemetic is recommended, and doses of 8 mg should be avoided. Regional anesthesia should be preferred whenever possible, as it facilitates post-operative pain control and reduces insulin resistance. Patients with poor glycemic control often require increased analgesic support. Preventing hypothermia, encouraging early mobilization, using minimally invasive surgical techniques, and minimizing blood loss are also beneficial in reducing insulin resistance-related perioperative complications.[31]

Perioperative Hypoglycemia

Symptoms of perioperative hypoglycemia may be masked under general anesthesia; thus, glucose levels must be closely monitored. Hypoglycemia is classified as follows:

- **Level 1:** <70 mg/dL
- **Level 2:** <54 mg/dL
- **Level 3:** <40 mg/dL

Hypoglycemia is particularly common in patients with Type 1 diabetes using insulin and in elderly patients on sulfonylureas. For treatment, administration of 25–50 mL of 50% dextrose solution or 500 mL of 5% dextrose is recommended.[31]

Approach to Hypoglycemia Risk in Perioperative Glycemic Management and Clinical Implications

The article titled "*Near Miss Hypoglycemia Reflections on Perioperative Glucose Management Guidelines in Diabetics*" highlights the weak points in clinical practice by examin-ing cases in which hypoglycemia was narrowly avoided. Attempting to maintain glucose levels within a narrow range (e.g., 4–6 mmol/L) increases the risk of hypoglycemia. Pro-longed pre-operative fasting and improper adjustment of antidiabetic agents – particularly insulin and sulfonylureas – can lead to perioperative hypoglycemia.

According to recent recommendations, it is advised that certain oral antidiabetic drugs (such as sulfonylureas) be withheld on the morning of surgery, and that doses of long-acting insulin be reduced by approximately 70–80%. It has been emphasized that variable rate intra-venous insulin infusions may cause abrupt glucose drops if glucose and caloric intake are not carefully managed. Furthermore, most hypoglycemic events have been linked to incom-plete handovers of insulin administration times or BG information during staff transi-tions.[32]

According to the most recent *Standards of Care in Diabetes – 2025* published by the American Diabetes Association, perioperative BG levels should be maintained between 80 and 180 mg/dL. Metformin and other oral glucose-lowering agents should be discontinued on the day of surgery. SGLT2 inhibitors should be stopped 3–4 days before surgery. Dos-es of NPH and long-acting insulins (e.g., glargine) should be reduced by 20–25% the day before surgery, and by approximately 50% on the morning of the procedure.[33]

Patients Using CSII

- In planned and short-duration surgeries, the insulin pump may be continued; basal infusion should be maintained, and glucose levels monitored hourly
- In emergency surgeries or procedures lasting longer than 3 h, the pump should be discontinued and transitioned to intravenous insulin infusion. BG should be main-tained within a target range of 140–180 mg/dL (7.7–10 mmol/L).[34]

CONCLUSION

In light of all this information, we at Bilkent City Hospital implement these protocols in our perioperative glucose management strategies and believe they will also serve as valuable guidance for other anesthesiologists.

DECLARATIONS

Informed Consent: All patients included in the study gave their verbal and written consent.

Conflict of Interest: The authors declare they have no conflict of interest with regard to the results of this study.

Funding: The authors declare they have received no funding during or after this study.

Use of AI for Writing Assistance: Artificial intelligence (ChatGPT, OpenAI) was used solely for grammar correction and language editing purposes. No AI was involved in data analysis, interpretation, or content generation.

Authorship Contributions: Concept – MŞ; Design – HG, MŞ; Supervision – HG; Fundings – MŞ; Materials – BNÇ; Data collection &/or processing – MŞ; Analysis and/or interpretation – MŞ; Literature search – BNÇ; Writing – EE; Critical review – EE, İEA, BNÇ.

Peer-review: Externally peer-reviewed.

REFERENCES

1. Türkiye Endokrinoloji ve Metabolizma Derneği. Diabetes mellitus ve komplikas-yonlarının tanı, tedavi ve izlem kılavuzu. Ankara: Türkiye Endokrinoloji ve Metabolizma Derneği; 2024.
2. Satman I, Yilmaz T, Sengül A, Salman S, Salman F, Uygur S, et al. Population-based study of diabetes and risk characteristics in Turkey: Results of the turkish di-abetes epidemiology study (TURDEP). Diabetes Care 2002;25:1551–6.
3. Satman I, Omer B, Tutuncu Y, Kalaca S, Gedik S, Dinccag N, et al. Twelve-year trends in the prevalence and risk factors of diabetes and prediabetes in Turkish adults. Eur J Epidemiol 2013;28:169–80.
4. Centers for Disease Control and Prevention (CDC). National diabetes statistics re-port 2023. Atlanta (GA): US Department of Health and Human Services; 2023.
5. Lazar HL, McDonnell M, Chipkin SR, Furnary AP, Engelman RM, Sadhu AR, et al. The Society of Thoracic Surgeons practice guideline series: Blood glucose ma-nagement during adult cardiac surgery. Ann Thorac Surg 2009;87:663–9.
6. Dungan KM, Braithwaite SS, Preiser JC. Stress hyperglycaemia. Lancet 2009;373:1798–807.
7. Umpierrez GE, Isaacs SD, Bazargan N, You X, Thaler LM, Kitabchi AE. Hy-perglycemia: An independent marker of in-hospital mortality in patients with undi-agnosed diabetes. J Clin Endocrinol Metab 2002;87:978–82.
8. Marik PE, Bellomo R. Stress hyperglycemia: An essential survival response! Crit Care 2013;17:305.
9. NICE-SUGAR Study Investigators; Finfer S, Chittock DR, Su SY, Blair D, Foster D, et al. Intensive versus conventional glucose control in critically ill patients. N Engl J Med 2009;360:1283–97.
10. Godinjak A, Iglica A, Burekovic A, Jusufovic S, Ajanovic A, Tancica I, et al. Hy-perglycemia in critically Ill patients: Management and prognosis. Med Arch 2015;69:157–60.

11. Li X, Wang J, Chen K, Li Y, Wang H, Mu Y, et al. Effect of different types of anesthesia on intraoperative blood glucose of diabetic patients: A PRISMA-compliant systematic review and meta-analysis. Medicine (Baltimore) 2017;96:e6451.
12. Zhang X, Hou A, Cao J, Liu Y, Lou J, Li H, et al. Association of diabetes mellitus with postoperative complications and mortality after non-cardiac surgery: A meta-analysis and systematic review. Front Endocrinol (Lausanne) 2022;13:841256.
13. American Diabetes Association. Standards of medical care in diabetes—2018. Dia-betes Care 2018;41:S1–159.
14. Sudhakaran S, Surani SR. Guidelines for perioperative management of the diabetic patient. Surg Res Pract 2015;2015:284063.
15. Dilworth L, Facey A, Omoruyi F. Diabetes mellitus and its metabolic complicati-ons: The role of adipose tissues. Int J Mol Sci 2021;22:7644.
16. Bailey CJ, Turner RC. Metformin. N Engl J Med 1996;334:574–9.
17. Rena G, Hardie DG, Pearson ER. The mechanisms of action of metformin. Diabe-tologia 2017;60:1577–85.
18. Petersen MC, Shulman GI. Mechanisms of insulin action and insulin resistance. Physiol Rev 2018;98:2133–23.
19. Adams JD, Egan AM, Laurenti MC, Schembri Wismayer D, Bailey KR, Cobelli C, et al. Insulin secretion and action and the response of endogenous glucose produc-tion to a lack of glucagon suppression in nondiabetic subjects. Am J Physiol En-docrinol Metab 2021;321:E728–36.
20. Hanefeld M, Josse RG, Chiasson JL. Alpha-glucosidase inhibitors for patients with type 2 diabetes: Response to van de Laar et al. Diabetes Care 2005;28:1841.
21. Drucker DJ. The biology of incretin hormones. Cell Metab 2006;3:153–65.
22. Zelniker TA, Wiviott SD, Raz I, Im K, Goodrich EL, Bonaca MP, et al. SGLT2 in-hibitors for primary and secondary prevention of cardiovascular and renal outcomes in type 2 diabetes: A systematic review and meta-analysis of cardiovascular outco-me trials. Lancet 2019;393:31–9.
23. Gasanova I, Meng J, Minhajuddin A, Melikman E, Alexander JC, Joshi GP. Preo-perative continuation versus ınterruption of oral hypoglycemics in type 2 diabetic patients undergoing ambulatory surgery: A randomized controlled trial. Anesth Analg 2018;127:e54–6.
24. Galway U, Chahar P, Schmidt MT, Araujo-Duran JA, Shivakumar J, Turan A, et al. Perioperative challenges in management of diabetic patients undergoing non-cardiac surgery. World J Diabetes 2021;12:1255–66.
25. American Diabetes Association. Standards of care in diabetes—2024. Diabetes Ca-re 2024;47:S1–300.
26. Rizvi AA, Chillag SA, Chillag KJ. Perioperative management of diabetes and hy-perglycemia in patients undergoing orthopaedic surgery. J Am Acad Orthop Surg 2010;18:426–35.
27. Joshi GP, Chung F, Vann MA, Ahmad S, Gan TJ, Goulson DT, et al. Society for Ambulatory Anesthesia consensus statement on perioperative blood glucose mana-gement in diabetic patients undergoing ambulatory surgery. Anesth Analg 2010;111:1378–87.
28. Spanakis EK, Levitt DL, Siddiqui T, Singh LG, Pinault L, Sorkin J, et al. The effect of continuous glucose monitoring in preventing ınpatient hypoglycemia in general wards: The glucose telemetry system. J Diabetes Sci Technol 2018;12:20–5.
29. Aleppo G, Laffel LM, Ahmann AJ, Hirsch IB, Kruger DF, Peters A, et al. A prac-tical approach to using trend arrows on the Dexcom G5 CGM system for the ma-nagement of adults with diabetes. J Endocr Soc 2017;1:1445–60.
30. Centre for Perioperative Care. Guideline for perioperative care for people with dia-betes mellitus undergoing elective and emergency surgery. London: CPOC; 2023.
31. Rajan N, Duggan EW, Abdelmalak BB, Butz S, Rodriguez LV, Vann MA, et al. Society for ambulatory anesthesia updated consensus statement on perioperative blood glucose management in adult patients with diabetes mellitus undergoing am-bulatory surgery. Anesth Analg 2024;139:459–77.
32. Ahmad R, Naftalovich R, Tewfik G, Eloy JD, Rodriguez-Correa DT. Near-miss hypoglycemia-reflections on perioperative glucose management guidelines in diabe-tics. BMC Anesthesiol 2023;23:190.
33. American Diabetes Association. Standards of care in diabetes—2025. Diabetes Ca-re 2025;48:S1–291.
34. Sreedharan R, Khanna S, Shaw A. Perioperative glycemic management in adults presenting for elective cardiac and non-cardiac surgery. Perioper Med (Lond) 2023;12:13.