REVIEW

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Managing noninsulin glucose-lowering medications before surgery: A comparison of clinical practice guidelines

ABSTRACT

Preoperative management of noninsulin glucose-lowering medications can be challenging as clinicians navigate adjustment amid decreased oral intake while maintaining euglycemia and avoiding hyper- or hypoglycemia. The authors review current published guidelines, along with the local protocol currently in place at Cleveland Clinic, to help clinicians determine which noninsulin glucose-lowering drugs may need to be held preoperatively and for how long.

KEY POINTS

- Some guidelines recommend holding metformin the day of surgery, and others say it can be continued for less invasive procedures or if normal oral intake is expected the same day.
- There is agreement that sulfonylureas should be held the day of surgery because of the risk of hypoglycemia.
- The US Food and Drug Administration and most authorities recommend holding sodium-glucose cotransporter 2 inhibitors at least 3 days before scheduled surgeries, and holding ertugliflozin 4 days before surgery due to its longer half-life and the potential for euglycemic ketoacidosis.
- Before ambulatory surgery, it is advised to hold weekly glucagon-like peptide 1 receptor agonist formulations for a week and the daily oral dose on the day of surgery. This guidance is expected to evolve as more data emerge.

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Glycemic control perioperatively can be challenging because of altered food intake, including fasting periods before surgery and possibly limited oral intake after the procedure. Effective management of type 2 diabetes medications during the preoperative period is essential to reduce the risk of day-of-surgery hyperglycemia, hypoglycemia, and postoperative complications.

To achieve these goals, diabetes medications, including noninsulin glucose-lowering agents, should be adjusted before both elective and emergency procedures (whenever possible). In this context, preventing hypoglycemia is a major concern. Patients on medications that stimulate insulin secretion, such as sulfonylureas, are at a particularly high risk for hypoglycemia. Additionally, it is crucial to prevent severe hyperglycemia, which can be exacerbated by the stress response associated with illness or surgery. This risk for hyperglycemia continues intraoperatively due to continued impact of the surgical stress response and the treatments used during surgery, such as steroids or intravenous fluids containing dextrose.

There are not enough studies evaluating specific strategies for adjusting diabetes medications preoperatively and their impact on important postsurgical outcomes.[1,2] Nevertheless, a few medical societies in the United States and Europe have developed clinical practice recommendations to address the use of noninsulin glucose-lowering medications before surgery.

These guidelines are based, for the most part, on physiologic and pharmacologic considerations, clinical experience, and the interpretation of data from available studies, which are limited and mostly observational.

This narrative review compares the guidelines from the American Diabetes Association (ADA),[3] the United Kingdom Centre for Perioperative Care (CPOC),[4] the Association of Anaesthetists of Great Britain and Ireland (AAGBI),[5] and the recently published update of the consensus statement on perioperative blood glucose management from the Society for Ambulatory Anesthesia (SAMBA).[2] Recommendations for adjusting the treatment regimen of each class of medication are discussed, as well as the latest preoperative anesthesia protocol for managing patients with diabetes currently in use at Cleveland Clinic.[6]

MEDICATION-SPECIFIC RECOMMENDATIONS

Metformin

Metformin, the most commonly prescribed medication for type 2 diabetes, is a biguanide that reduces hepatic glucose production and, to a lesser extent, increases insulin sensitivity. It has high glucose-lowering efficacy and is associated with minimal risk of hypoglycemia.[7] The most common side effects are gastrointestinal symptoms, including diarrhea, bloating, cramping, and nausea.

Metformin is contraindicated in patients with advanced renal failure (estimated glomerular filtration rate [eGFR] < 30 mL/min/1.73 m^2) because it can induce lactic acidosis,which is a very rare adverse effect but a severe condition (**Table 1**).[7,8] Metformin-associated lactic acidosis is thought to be multifactorial, with increased plasma levels of lactate resulting from the inhibition of hepatic gluconeogenesis, which leads to the accumulation of lactate and its substrates. Additionally, enhanced anaerobic glycolysis and increased conversion of glucose to lactate in the small intestine are contributing factors.[9] Other patients at risk for lactic acidosis should also avoid metformin, including those with severe liver disease, tissue hypoxia, or hypoperfusion (eg, decompensated heart failure, sepsis, shock).

Comparison of recommendations. The ADA recommends withholding metformin on the day of surgery, but guidelines from other societies lack consensus on this practice (**Table 2**)[2–5,10] Typically, metformin does not induce hypoglycemia during short periods of fasting, and continuing metformin treatment may not be associated with a clinically significant increase in perioperative plasma lactate levels.[11] The SAMBA consensus statement[2] advises patients undergoing ambulatory surgery to take metformin on the day of surgery unless their eGFR is less than 45 mL/min/1.73 m^2 or the procedure involves renally toxic agents. Similarly, the British and Irish guidelines[4,5] allow patients to take once-daily or twice-daily metformin as usual on the day of surgery (**Table 2**). Exceptions include procedures requiring contrast agents or patients with an eGFR less than 60 mL/min/1.73 m^2. In these cases, metformin should be withheld on the day of surgery and for 48 hours afterward.[5]

Some authors suggest taking metformin on the day of surgery if the procedure is minimally invasive and normal oral intake is expected the same day.[12] However, they recommend withholding metformin on the day of surgery when an extensive procedure is planned, decreased postoperative oral intake is anticipated, or significant fluid shifts and hemodynamic changes are likely. One consideration is the possibility of unexpected perioperative complications, such as acute kidney injury, hypotension, infections, or the unanticipated need for imaging studies requiring intravenous contrast dye. These unpredictable clinical scenarios can make the use of metformin undesirable. In this context, a conservative approach may be warranted.

Cleveland Clinic currently follows the ADA recommendations and advises patients to withhold metformin on the day of surgery (**Table 3**).[3,6]

Sulfonylureas

Sulfonylureas, one of the oldest classes of medications used to treat type 2 diabetes, work by increasing basal and meal-stimulated insulin secretion from the beta cells of the pancreas.

Comparison of recommendations. Because of the risk of hypoglycemia, particularly during fasting, the consensus among guidelines is to hold sulfonylureas the morning of surgery (**Table 2**). Generally, treatment with sulfonylureas can be continued the day before surgery; however, we recommend discontinuing these medications sooner if the patient is expected to follow a low-carbohydrate diet for several days before the procedure (eg, before bariatric surgery).[13]

Meglitinides

The meglitinides (repaglinide and nateglinide) are less commonly used for diabetes management compared with other oral hypoglycemic agents. Like sulfonylureas, meglitinides stimulate insulin secretion in the pancreas; however, they have a shorter half-life, require administration multiple times a day with meals, and are used to control postprandial hyperglycemia.

TABLE 1
Half-lives of noninsulin glucose-lowering medications and potential adverse effects relevant in the perioperative period

Medication	Half-life[a]	Adverse effects
Metformin	4–9 hours	Lactic acidosis (rare)
Sulfonylureas		Hypoglycemia
Glipizide intermediate release	2–5 hours	
Glimepiride	5–9 hours	
Glyburide	~10 hours	
Meglitinides		Hypoglycemia
Repaglinide	~1 hour	
Nateglinide	~1.5 hours	
Thiazolidinediones		Fluid retention
Pioglitazone	3–7 hours	
Alpha-glucosidase inhibitors		Flatulence, diarrhea, abdominal pain
Acarbose	~2 hours	
Dipeptidyl peptidase 4 inhibitors		
Alogliptin	~21 hours	
Linagliptin	12 hours	
Sitagliptin	~12.4 hours	
Saxagliptin	~2.5 hours	
Sodium-glucose cotransporter 2 inhibitors		Volume depletion, hypotension, diabetic ketoacidosis (euglycemic diabetic ketoacidosis)
Canagliflozin	10–13 hours	
Dapagliflozin	~12.9 hours	
Empagliflozin	~12.4 hours	
Bexagliflozin	~12 hours	
Ertugliflozin	~16.6 hours	
Glucagon-like peptide-1 receptor agonists, daily administration formulations		Nausea, vomiting, delayed gastric emptying
Exenatide	2.4 hours	
Liraglutide	13 hours	
Oral semaglutide	7 days	
Glucagon-like peptide-1 receptor agonists, weekly subcutaneous injection formulations		Nausea, vomiting, delayed gastric emptying
Dulaglutide	5 days	
Semaglutide	7 days	
Dual glucose-dependent insulinotropic polypeptide and glucagon-like peptide-1 receptor agonist		Nausea, vomiting, delayed gastric emptying
Tirzepatide	5 days	

[a]UpToDate Lexidrug. Wolters Kluwer. http://online.lexi.com. Accessed June 13, 2025.

Comparison of recommendations. Due to their shorter duration of action, meglitinides are associated with a lower risk of hypoglycemia compared with sulfonylureas.[14] The SAMBA consensus statement[2] advises discontinuing meglitinides on the day of surgery. However, for procedures scheduled in the afternoon, the CPOC[4] and AAGBI[5] guidelines recommend giving the morning dose of repaglinide or nateglinide if the patient is eating (**Table 2**). For patients scheduled for bariatric surgery, it is recommended that meglitinides be discontinued at the start of the preoperative full-liquid, low-calorie diet, which typically begins about 2 weeks before the surgery.[13]

Thiazolidinediones

Thiazolidinediones (pioglitazone and rosiglitazone) are peroxisome proliferator–activated receptor gamma

TABLE 2
Medical society recommendations on adjusting noninsulin glucose-lowering medications before surgical procedures

Medication	ADA (2024)[3]	CPOC (2023)[4]	AAGBI (2019)[5]	SAMBA (2024)[2]
Metformin	Hold day of surgery	AM surgery or PM surgery: if taken once or twice a day, take as normal; if taken 3 times daily, omit lunchtime dose Hold if acute kidney injury or eGFR < 30 mL/min/1.73 m^2 Omit day of surgery and for 48 hours after if contrast dye will be used or eGFR < 60 mL/min/1.73 m^2	Take as normal day of surgery[a] Omit on day of surgery and for 48 hours after if contrast dye will be used or eGFR < 60 mL/min/1.73 m^2	Take day of surgery unless eGFR < 45 mL/min/1.73 m^2 or procedure includes nephrotoxic agents (eg, contrast dye)[c]
Sulfonylureas	Hold morning of surgery[b]	AM surgery: omit on morning of surgery; if taken twice daily, take evening dose if eating PM surgery: do not take on day of surgery	AM surgery: omit if taken once daily (morning); if taken twice daily, omit morning dose[a] PM surgery: omit if taken once daily (morning); if taken twice daily, omit both doses[a]	Hold day of surgery[c]
Meglitinides	Hold morning of surgery[b]	For AM surgery, omit morning dose if not eating; for PM surgery, give morning dose if eating	For AM surgery, omit morning dose if not eating[a]; for PM surgery, give morning dose if eating[a]	Hold day of surgery[c]
Thiazolidinediones	Hold morning of surgery[b]	Take as normal on day of surgery	Take as normal day of surgery[a]	Take day of surgery[c]
Alpha-glucosidase inhibitors	Hold morning of surgery[b]	For AM surgery, omit morning dose if not eating; for PM surgery, give morning dose if eating	For AM surgery, omit morning dose if not eating[a]; for PM surgery, give morning dose if eating[a]	Hold for morning surgery (may take if patient eats morning meal)[c]
DPP-4 inhibitors	Hold morning of surgery[b]	Take as normal day of surgery	Take as normal day of surgery[a]	Take day of surgery[c]
SGLT-2 inhibitors	Hold 3–4 days before surgery	Omit day before surgery and day of surgery[d]	Do not take day of surgery[a,e]	Hold 3 days before surgery (hold ertugliflozin 4 days before)[c]
GLP-1 receptor agonists, daily and weekly formulations	No specific recommendation[f]	Take as normal day of surgery[g]	Take as normal day of surgery[a]	Hold daily formulations day of surgery[c] and weekly formulations a week before surgery[c,h]
Dual GIP and GLP-1 receptor agonist	No specific recommendation	No specific recommendation	No specific recommendation	Take day of surgery (may hold if patient often has nausea or vomiting after taking or is at high risk for postoperative nausea and vomiting)[c,h]

[a]Guideline for short starvation period: no more than 1 missed meal.
[b]The ADA gives specific recommendations for metformin and SGLT-2 inhibitors and advises holding other oral glucose-lowering drugs the morning of surgery or procedure.
[c]Guidelines for patients undergoing ambulatory surgery.
[d]Check blood ketones daily if patient with diabetes is normally on SGLT-2 inhibitors even if glucose concentrations are normal.
[e]If oral intake will decrease before a procedure, stop the drug the day intake is reduced.
[f]Data on the safe use and effects of GLP-1 receptor agonists on glycemia and gastric emptying during the perioperative period are limited.
[g]These drugs should be continued for perioperative glycemic control, but precautions are needed to prevent pulmonary aspiration.
[h]The American Society of Anesthesiologists recommends considering holding weekly dosing GLP-1 agonists a week before the procedure or surgery.[10]

AAGBI = Association of Anaesthetists of Great Britain and Ireland; ADA = American Diabetes Association; CPOC = Centre for Perioperative Care; DPP-4 = dipeptidyl peptidase 4 inhibitors; GIP = glucose-dependent insulinotropic polypeptide; GLP-1 = glucagon-like peptide 1; eGFR = estimated glomerular filtration rate; SAMBA = Society for Ambulatory Anesthesia; SGLT-2 = sodium-glucose cotransporter 2

TABLE 3
Cleveland Clinic Anesthesiology Institute preoperative medication guidelines for diabetes[6]

Medication	Days before surgery	Day of surgery
All oral hypoglycemics (except sodium-glucose cotransporter 2 inhibitors)	Continue	Hold all on day of surgery
Sodium-glucose cotransporter 2 inhibitors		
All except ertugliflozin	Hold 3 days preoperatively	Hold
Ertugliflozin	Hold 4 days preoperatively	Hold
Glucagon-like peptide 1 receptor agonists		
Oral or daily injectable	Continue	Hold
Weekly injectable	Hold the dose the week before surgery	Hold

Note: Guidelines revised October 2023. Regimens can be adjusted based on clinical judgment and on individual patient basis.

agonists that enhance insulin sensitivity. Thiazolidinediones have high efficacy in lowering blood glucose and are rarely associated with hypoglycemia. Additionally, these medications positively impact nonalcoholic fatty liver disease (now called metabolic dysfunction–associated steatotic liver disease) by improving histologic markers.[15] Side effects include weight gain, fluid retention, and edema; thiazolidinediones are contraindicated in patients with moderate to severe heart failure.[16]

Comparison of recommendations. Given the low risk of hypoglycemia associated with thiazolidinediones, the SAMBA consensus statement[2] recommends taking these medications on the day of surgery. However, they recommend exercising caution in patients who are at risk of or currently experiencing increased fluid retention.[2] The CPOC[4] and AAGBI[5] guidelines also permit taking thiazolidinediones as usual on the day of the procedure (**Table 2**). Some experts propose withholding thiazolidinediones on the day of surgery for extensive procedures or when significant hemodynamic or fluid volume changes are expected.[12] The ADA clinical practice recommendations[3] do not offer specific guidance on adjusting thiazolidinediones preoperatively; however, they do advise withholding oral glucose-lowering medications on the morning of surgery.

At Cleveland Clinic, patients are asked to withhold thiazolidinediones on the morning of their scheduled procedure (**Table 3**).[6]

Alpha-glucosidase inhibitors

The alpha-glucosidase inhibitors (acarbose and miglitol) block the enzyme alpha-glucosidase in the brush border of the small intestine. Through this mechanism, these oral agents decrease the intestinal absorption of carbohydrates and help control postprandial hyperglycemia.[17] Gastrointestinal side effects are relatively common among patients taking these medications and include flatulence, diarrhea, and abdominal pain.

Comparison of recommendations. The SAMBA consensus statement[2] recommends holding alpha-glucosidase inhibitors on the day of the surgery if the patient is fasting. However, they can be taken if the patient eats a morning meal. Similarly, the CPOC[4] and AAGBI[5] guidelines recommend omitting the morning dose if the patient is not eating. For afternoon surgeries, the morning dose can be administered if the patient eats (**Table 2**). This situation, however, is rarely encountered as patients are typically instructed to fast for 8 hours (solid food) or 6 hours (light meals), and patients may be asked to avoid eating for longer in case of last-minute schedule changes if their procedure is scheduled for very late in the day. Although carbohydrate-containing clear liquids are permitted and encouraged up to 2 hours before a procedure, this would not be considered a meal.[18] Cleveland Clinic Anesthesiology Institute preoperative medication guidelines do not give specific recommendations for alpha-glucosidase inhibitors.[6] However, as shown in **Table 3**, Cleveland Clinic guidelines recommend holding all oral medications on the day of surgery.

Dipeptidyl peptidase 4 inhibitors

Dipeptidyl peptidase (DPP) 4 inhibitors are oral medications that inhibit the enzymatic activity of DPP-4, a protease that inactivates glucagon-like peptide (GLP) 1 and glucose-dependent insulinotropic polypeptide (GIP). By increasing the circulating levels of these incretin hormones, DPP-4 inhibitors enhance glucose-dependent insulin secretion and reduce glucagon levels.[19] Several

DPP-4 inhibitors are available for clinical use, including alogliptin, linagliptin, sitagliptin, and saxagliptin. They all have intermediate efficacy in lowering blood glucose, are seldom linked to hypoglycemia, and are typically well tolerated. Alogliptin, sitagliptin, and saxagliptin require dose adjustments for patients with renal impairment, while linagliptin does not. Rare but serious side effects associated with DPP-4 inhibitors include hypersensitivity reactions and acute pancreatitis.[7] The US Food and Drug Administration has also warned about a possible increase in the risk of heart failure in patients taking saxagliptin or alogliptin, particularly among those with preexisting cardiac or renal disease.[20]

Comparison of recommendations. Due to the overall favorable safety profile of DPP-4 inhibitors and minimal risk of hypoglycemia with their use, many experts recommend continuing treatment with these medications on the day of surgery and throughout the perioperative course.[12] Evidence from randomized controlled trials supports the safety and effectiveness of DPP-4 inhibitors for inpatient management of type 2 diabetes in select patients with mild to moderate hyperglycemia.[21,22] Given the current evidence, the SAMBA consensus statement,[2] along with the CPOC[4] and AAGBI[5] guidelines, all recommend taking DPP-4 inhibitors as usual on the day of surgery (**Table 2**). The ADA[3] suggests withholding oral glucose-lowering agents on the morning of surgery. However, they note that the use of DPP-4 inhibitors may be considered for certain groups of hospitalized patients with type 2 diabetes.

Sodium-glucose cotransporter 2 inhibitors

Sodium-glucose cotransporter (SGLT) 2 inhibitors are a group of medications that promote glycosuria by blocking renal tubular glucose reabsorption. This leads to a reduction in both fasting and postprandial blood glucose levels.[23–25] Additionally, SGLT-2 inhibitors improve cardiac and renal outcomes and are currently approved for treating type 2 diabetes, heart failure, and chronic kidney disease.[26,27] Medications in the SGLT-2 inhibitor class include canagliflozin, dapagliflozin, empagliflozin, ertugliflozin, and bexagliflozin. The use of SGLT-2 inhibitors has increased in recent years, and it is likely that their use will become more common in patients undergoing both elective and emergency surgeries.[28]

SGLT-2 inhibitors have intermediate glucose-lowering efficacy and are associated with a very low risk of hypoglycemia. The most common side effect of SGLT-2 inhibitors is genital mycotic infections. Urinary tract infections can also occur, along with rare cases of Fournier gangrene.[27] Other issues to consider are the potential for volume depletion related to osmotic diuresis, orthostatic symptoms, hypotension, and transient increase in serum creatinine levels.

Euglycemic diabetic ketoacidosis risk. An uncommon but significant side effect is diabetic ketoacidosis, which, in patients taking SGLT-2 inhibitors, often presents as euglycemic diabetic ketoacidosis (plasma glucose < 200 mg/dL).[27,29,30] The absence of hyperglycemia and its occurrence in patients with type 2 diabetes can mislead clinicians, potentially delaying diagnosis and appropriate treatment. The pathophysiology of SGLT-2 inhibitor–induced euglycemic diabetic ketoacidosis is not yet fully elucidated but is thought to involve several mechanisms, including a decreased insulin-to-glucagon ratio, enhanced lipolysis and ketogenesis, and impaired renal clearance of ketone bodies.[31] Precipitating factors for diabetic ketoacidosis in patients taking SGLT-2 inhibitors include a low-carbohydrate diet, dehydration, severe acute illness, and surgery.[32] Although the overall incidence of diabetic ketoacidosis in patients treated with SGLT-2 inhibitors who undergo surgery is low, it is a severe complication that requires intensive medical care and can be fatal.[29,31–33]

Comparison of recommendations. The CPOC guideline[4] recommends checking blood ketones daily for patients on SGLT-2 inhibitors even if glucose concentrations are normal. While such a recommendation sounds logical, it is impractical, and we do not believe it is warranted. At Cleveland Clinic, if the patient's clinical presentation suggests diabetic ketoacidosis, a rapid arterial blood gas is first checked and, if the arterial blood gas shows metabolic acidosis, blood ketones are checked.

The US Food and Drug Administration advises discontinuing SGLT-2 inhibitors at least 3 days before scheduled surgeries and 4 days before surgery if taking ertugliflozin due to its longer half-life (**Table 1**).[34] The ADA[3] and the SAMBA[2] consensus statements recommend the same, and Cleveland Clinic[6] also endorses this guidance (**Table 2** and **Table 3**). Clinicians should consider discontinuing SGLT-2 inhibitors earlier in patients undergoing bariatric surgery while they are following a very-low-calorie diet.[5,13]

GLP-1 and dual GIP and GLP-1 receptor agonists

GLP-1 receptor agonists and dual GIP and GLP-1 receptor agonists are classes of medications used for managing type 2 diabetes and obesity.[35,36] GLP-1 receptor agonists are incretin mimetics that stimulate insulin production after carbohydrate intake, inhibit glucagon secretion, delay gastric emptying, and suppress appetite.[35] GLP-1 receptor agonists are administered

either via daily or weekly subcutaneous injections or as an oral tablet taken daily (semaglutide). There are differences in the glucose-lowering efficacy among individual GLP-1 receptor agonists, ranging from intermediate to very high. Despite these variations, all GLP-1 receptor agonists are associated with a low risk of hypoglycemia.[35,37]

GLP-1 receptor agonists have revolutionized medical weight management and the treatment of type 2 diabetes, and are now considered first-line pharmacotherapy for individuals with type 2 diabetes who have atherosclerotic cardiovascular disease, are at high risk for cardiovascular disease, or have overweight.[7] Tirzepatide, the first dual GIP and GLP-1 receptor agonist, has shown even more significant improvements in blood glucose levels and greater weight loss compared with GLP-1 receptor agonists alone.[38,39] The most common side effects of GLP-1 receptor agonists and tirzepatide are gastrointestinal symptoms, including nausea, vomiting, diarrhea, constipation, and decreased appetite.[35,36,38]

Comparison of recommendations. Delayed gastric emptying may increase the risk of regurgitation during general anesthesia and, consequently, the risk of pulmonary aspiration,[40] which can be a fatal perioperative complication.[41] As such, the American Society of Anesthesiologists Task Force on Preoperative Fasting[10] recommends holding GLP-1 agonists 1 week before scheduled elective procedures for patients on weekly dosing. For patients on daily dosing GLP-1 receptor agonists, it is appropriate to hold the medications on the day of the procedure. These recommendations are supported by some emerging data. In a cross-sectional study of 124 patients, increased residual gastric volume in the form of solids, thick liquids, or more than 1.5 mL of clear liquids per kilogram was found in 56% of patients on GLP-1 receptor agonist treatment vs 19% of patients who were not, despite fasting.[42] Additionally, in a retrospective database analysis of about 778,000 GLP-1 receptor agonist nonusers and 20,000 users from 80 healthcare systems who underwent only upper and lower endoscopy, aspiration incidence rates were 0.63% vs 0.83%, respectively.[43]

However, the recommendation to hold GLP-1 receptor agonists the week before surgery has become somewhat controversial due to concerns about unintended consequences, such as delayed procedures and poorer control of perioperative hyperglycemia.[44] In fact, contradictory guidance comes from the American Gastroenterological Association,[44] which suggests there is no need to hold GLP-1 receptor agonists before upper or lower endoscopy as long as patients have followed typical fasting procedures and are asymptomatic. This has been somewhat supported by a meta-analysis that did not find a clinically significant gastric-emptying delay in patients on GLP-1 receptor agonists and a retrospective analysis that did not show any increase in respiratory complications in patients on GLP-1 receptor agonists undergoing emergency surgery.[45,46] This issue is currently still an area of active research.

As of now, the SAMBA consensus statement[2] advises holding weekly GLP-1 receptor agonist subcutaneous injection formulations for a week and the daily oral dose on the day of surgery for patients undergoing ambulatory surgery, while the ADA does not provide specific recommendations due to the limited available evidence (**Table 2**).[2–6] After surgery, most patients can restart treatment with the GLP-1 receptor agonist at the same dose. However, if the medication is held for a prolonged period, restarting at a lower dose may be recommended, depending on the specific agent and the presence of gastrointestinal symptoms, to minimize side effects. Currently, the Cleveland Clinic Anesthesiology Institute protocol[6] calls for holding weekly injectable GLP-1 receptor agonists the week before surgery (**Table 3**). These recommendations are expected to evolve as more data emerge.

FINAL THOUGHTS

Type 2 diabetes is a very common disease, and a frequent clinical scenario involves adjusting the diabetes medication regimen for patients undergoing surgical procedures. This adjustment is crucial to prevent hypoglycemia, severe hyperglycemia, and perioperative complications related to specific medications.[47,48] Of note, recommendations from various medical societies and health systems tend to err on the side of hyperglycemia since hypoglycemia tends to be more detrimental to the patient than hyperglycemia.

Despite the importance of this issue, the body of evidence is limited in both quantity and quality. Guidelines from international societies offer differing and sometimes contradictory recommendations, often based on diverse expert opinions. Other differences exist because some guidelines are directed toward a specific group of patients. The SAMBA[2] recommendations are a clear example, as they are intended for ambulatory (same-day surgery) patients who are presumably undergoing a less invasive surgery and will resume their oral intake shortly, whereas other guidelines are meant to be generalized for all patients.

Moreover, each institution should develop and implement protocols based on the patient population they serve and their specific operational and clinical

practices, demonstrated here by the inclusion of the current guidelines from Cleveland Clinic.[6] To help prevent surgery or procedure cancellations due to discrepancies in perioperative management practice, it is also important that clinicians performing preoperative evaluations be familiar with local protocols at the surgical centers where patients are being referred. Moreover, these centers should make their local policies and instructions very clear to their patients when they communicate with them preoperatively.

As more studies illuminate the clinical questions surrounding the perioperative management of noninsulin diabetes medications, these guidelines should be regularly reviewed and updated to reflect the best available evidence.

DISCLOSURES

Dr. Abdelmalak has disclosed teaching and speaking for Medtronic and Mindray North America. Dr. Morey-Vargas has disclosed teaching and speaking for Asofarma. The other authors report no relevant financial relationships which, in the context of their contributions, could be perceived as a potential conflict of interest.

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