Received: 7 December 2025 | Accepted: 12 February 2026

DOI: 10.1111/dme.70281

DIABETIC Medicine

POSITION STATEMENT

Diabetes management in people undergoing metabolic-bariatric surgery: A guideline from the Joint British Diabetes Societies for Inpatient Care (JBDS-IP) Group

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Abstract

The global prevalence of obesity and diabetes continues to rise, with metabolic-bariatric surgery recognised as an effective intervention for obesity and type 2 diabetes, offering potential for type 2 diabetes remission and improved glycaemic control. This guideline, developed by the Joint British Diabetes Societies for Inpatient Care (JBDS-IP), provides recommendations for the management of diabetes in individuals undergoing metabolic-bariatric surgery. It emphasises the importance of multidisciplinary care and individualised treatment plans to optimise outcomes. Key recommendations include pre-operative glycaemic optimisation, targeting HbA1c <69 mmol/mol (<8.5%) where safe to do so, prevention of hypoglycaemia throughout all phases of care and providing a framework for medication adjustments during the liver reduction diet (LRD), peri-operative and post-operative phases. For type 2 diabetes, oral and non-insulin therapies such as metformin, DPP4 inhibitors and GLP-1 based therapies may be continued during LRD, while sulfonylureas, meglitinides and SGLT2 inhibitors should be discontinued to reduce the risk of hypoglycaemia. For those with type 2 diabetes on insulin, doses should be reduced by 35%–50% during LRD and adjusted post-operatively based on individual glycaemic control. To prevent diabetic ketoacidosis (DKA) in those with type 1 diabetes, insulin must never be stopped and careful planning with diabetes teams is essential. Post-operatively, regular glucose monitoring, hypoglycaemia surveillance, medication adjustments, and follow-up with diabetes specialists are recommended. This document serves as a guide for clinicians and service commissioners, aiming to improve inpatient diabetes care and outcomes for individuals undergoing metabolic-bariatric surgery.

KEYWORDS

bariatric surgery, hospital, inpatient diabetes, metabolic surgery

1 | INTRODUCTION

The global prevalence of obesity and diabetes is rising. Obesity is associated with a higher risk of obesity-related complications, along with economic and societal impact. The role of metabolic-bariatric surgery as effective interventions for obesity and type 2 diabetes is well recognised, particularly in achieving type 2 diabetes remission or improvement in glycaemic control, treatment impact and improvements in associated complications.[1–4]

Suboptimal pre-operative management of glucose is associated with dysglycaemia (hyperglycaemia and hypoglycaemia) in the peri-operative period, a risk for infections, poor wound healing and increased length of stay.[5] This guideline uses the pre-operative HbA1c cut off of 69 mmol/mol (8.5%) as set out in the 2011 JBDS-IP and NHS Diabetes consensus advice and guideline for elective cases.[6] Planning diabetes management ahead of metabolic-bariatric surgery is essential in supporting the best outcome for individuals. An individualised approach to care is therefore important. The role of multidisciplinary care in diabetes, anaesthesia, surgery and other conditions is well recognised in the literature, national and international guidelines.[5,7]

Hypoglycaemia is defined as blood glucose <4 mmol/L. Prevention and management of hypoglycaemia must be considered when planning and during the peri-operative and post-operative phases of surgery in all those at risk (on insulin and insulin secretagogues).[5]

This guideline does not examine the diabetes complications including microvascular/macrovascular complications and impaired hypoglycaemia awareness. These need to be addressed and managed according to the local and national guidelines.

This is the first JBDS-IP guideline dedicated to the management of diabetes in people undergoing metabolic-bariatric surgery. It provides an overview of the management, starting at the point of consideration for metabolic-bariatric surgery. It is aimed at all those who care for people with diabetes undergoing metabolic-bariatric surgery, whether specialist or not. This is guidance and there is a caveat that all people require individualised treatment during this process.

2 | SUMMARY VISUALISATION

Figure 1 summarises the guidelines and provides a quick reference for busy clinicians.

What's new?

- Practical advice on diabetes medication adjustments during the pre-operative, liver reduction diet, peri-operative and post-operative phases of metabolic-bariatric surgery.
- Aligns with Centre for Perioperative Care (CPOC) diabetes guidelines.
- Recommendations for involving the diabetes specialist team.
- Visual summary of the guidelines recommendations.

3 | RECOMMENDATIONS

3.1 | For primary care

1. Ensure that the referral letter states all of the recommended information outlined in local/national available guidelines which form the standard accepted management of people with diabetes undergoing surgery (e.g. Centre for Perioperative Care [CPOC] Guideline for Perioperative Care for People with Diabetes Mellitus Undergoing Elective and Emergency Surgery [updated October 2023]).[5]
2. If the individual has any type of diabetes, ensure that glycaemic optimisation starts at the time of the initial referral in line with the current guidelines. Aim to achieve an HbA1c <69 mmol/mol (<8.5%), where it is safe to do so including prevention of hypoglycaemia.[5]

3.2 | For the specialist metabolic-bariatric surgery service

1. In collaboration with the individual's usual diabetes care provider, ensure glycaemic optimisation (including prevention of hypoglycaemia) is achieved within an optimal timeframe for surgery. We would recommend within 2 months of surgery. If it is not achievable, or unsafe to do so, this should be communicated to the metabolic-bariatric surgery team.
2. At the start of the liver reduction diet (LRD) ensure that the individual with diabetes is given written instructions and understands the importance of adhering to the necessary pharmacological changes

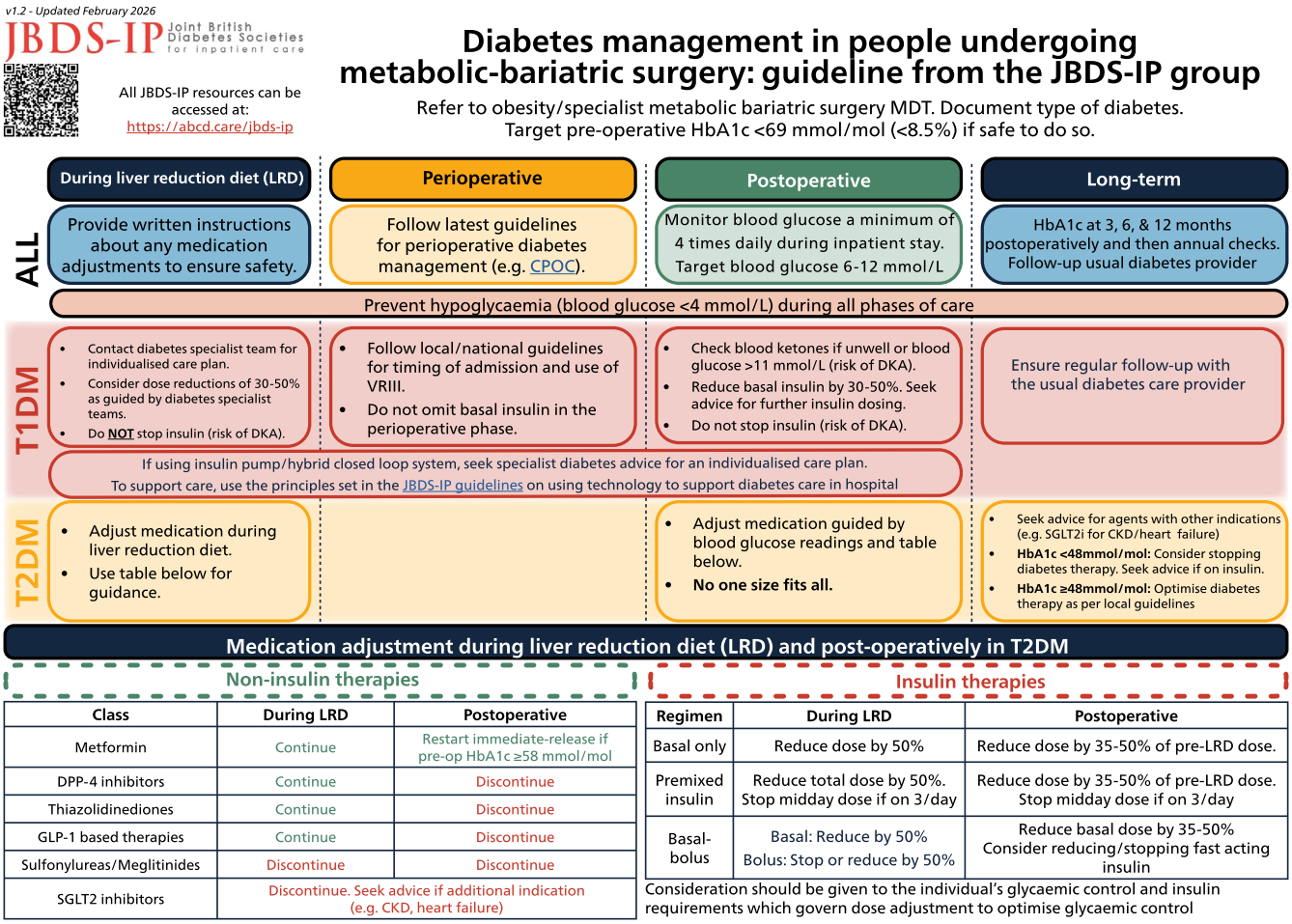

FIGURE 1 Summary of the guidelines illustrated by the phases of care: Referral, during liver reduction diet, peri-operative, post-operative and long term.

needed to ensure their safety and prevention of hypoglycaemia.

3. Ensure the classification of diabetes (e.g. autoimmune diabetes, type 2 diabetes, secondary diabetes) is clearly documented prior to surgical referral and assessment.

3.3 | The peri-operative period

Follow the latest local/national available guidelines which form the standard accepted management of people with diabetes undergoing surgery e.g. CPOC Guideline for Perioperative Care for People with Diabetes Mellitus Undergoing Elective and Emergency Surgery (updated October 2023).[5]

3.4 | The post-operative period

1. Ensure that glucose concentrations are monitored regularly and kept in the recommended range. For those on glucose lowering therapies, use CPOC target blood glucose of 6–12 mmol/L and prevention of hypoglycaemia (blood glucose <4 mmol/L) OR use your recommended local target. For those treated with dietary modification alone, or medications which do not cause hypoglycaemia (e.g. metformin, DPP4 inhibitors), recommend an acceptable blood glucose range of 4–12 mmol/L.[5]

2. Depending on their pre-operative HbA1c, rapid modifications of the doses of the usual diabetes medication may be necessary **(remembering that those with type 1 diabetes must never have their insulin stopped)**.

4. Depending on the ability to take medication orally, modification of the formulations of medications may be necessary.

5. All people with diabetes who have undergone metabolic-bariatric surgery should have access to the diabetes specialist team prior to discharge to ensure timely review, addressing any concerns (e.g. hypoglycaemia), and to plan post-discharge care.

4 | PRINCIPLES OF MANAGEMENT AND RECOMMENDATIONS

4.1 | Pre-operative planning in preparation for metabolic-bariatric surgery

When a referral is made, follow the latest local/national available guidelines which form the standard accepted management of people with diabetes undergoing surgery. For example, the latest CPOC guidelines[5]

Once the decision has been made to proceed with surgery, the following should be considered:

a. Confirmed the diagnosis of diabetes on referral. For individuals with type 1 diabetes, the usual diabetes care providers must be contacted early to allow careful optimisation, prevention of hypoglycaemia and planning of surgery.
b. HbA1c to be measured and communicated to the specialist metabolic-bariatric surgery MDT coordinator prior to the individual being listed for surgery (within 3 months). HbA1c should ideally be <69 mmol/mol (<8.5%)[5] where this can be safely achieved.
c. If HbA1c ≥69 mmol/mol (≥8.5%), the specialist metabolic-bariatric surgery multi-disciplinary team (MDT) should refer to the local diabetes care provider (GP/intermediate care/secondary care) for optimisation of glycaemic control, where it is safe to do so.
d. Check HbA1c at operative pre-assessment:
   - If HbA1c <69 mmol/mol (<8.5%), the individual should be considered fit to proceed from a diabetes perspective.[5]
   - If HbA1c ≥69 mmol/mol (≥8.5), the specialist metabolic-surgery MDT should contact the individual's diabetes care provider to optimise glycaemic control, if it is appropriate to do so.[5]
e. Once HbA1c <69 mmol/mol (<8.5%), proceed to surgery. Alternatively, the HbA1c and/or other evidence of glycaemic control can be reviewed by the specialist metabolic-bariatric surgery MDT and a decision made to proceed with surgery with a suboptimal HbA1c.[5]
f. Many individuals are required to undertake a LRD, typically 2–4 weeks prior to surgery.[8] The metabolic-bariatric surgery MDT should prepare a pre-operative diabetes medication management plan for this period and inform the individual, GP and diabetes care providers.
g. A member of the MDT should review the individual regularly whilst awaiting surgery.

4.2 | Type 2 diabetes mellitus

4.2.1 | Changes to diabetes medication during the LRD

4.2.1.1 | *Type 2 diabetes managed on diet alone*

If type 2 diabetes is managed on diet alone with no medication, no changes are required.

4.2.1.2 | *Oral and non-insulin-based therapies agents during the LRD*

Table 1 summarises the changes for oral and non-insulin-based therapies during the LRD. Biguanides,

TABLE 1 Oral and non-insulin-based therapies agents during the liver reducing diet (LRD).

Class of medication	(not exhaustive list)	Action
Biguanide	Metformin	Continue during LRD
Dipeptidyl peptidase-4 inhibitors	Alogliptin, Linagliptin, Saxagliptin, Sitagliptin, Vildagliptin	Continue during LRD
Thiazolidinediones	Pioglitazone	Continue during LRD
GLP-1 based therapies	Exenatide, Dulaglutide, Liraglutide, Semaglutide, (including Rybelsus®), Tirzepatide	Continue during LRD
Sulfonylureas	Glibenclamide, Gliclazide, Glimepiride, Glipizide	Discontinue at start of LRD
Meglitinides	Repaglinide	Discontinue at start of LRD
SGLT2 inhibitors	Canagliflozin, Dapagliflozin, Empagliflozin, Ertugliflozin	Discontinue at start of LRD Seek additional input from the diabetes team if there is an additional indication for the SGLT2i (e.g. chronic kidney disease, heart failure) and when to initiate again

dipeptidyl peptidase-4 inhibitors (DPP-4 inhibitors or 'gliptins'), thiazolidinediones ('glitazones') and glucagon-like peptide-1 receptor-based therapies (GLP-1 receptor agonists and dual agonists) may be continued. Sulfonylureas, meglitinides and sodium glucose transporter-2 (SGLT2) inhibitors should be discontinued. It is important to note that the examples listed in Table 1 are not exhaustive, and are subject to change depending on the availability of medications where clinicians practise.[4]

4.2.1.3 | *Insulin therapy during the LRD*

The total daily dose of different insulin regimes can be reduced to 50% of the pre-LRD dosage.[4] Table 2 summarises the changes for insulin-based therapies during the LRD. All individuals with diabetes on sulfonylureas, meglitinides or insulin therapies must have access to and knowledge of how to perform blood glucose monitoring and how to prevent and manage hypoglycaemia. Peri-operative metabolic-bariatric team should check availability with the individual with diabetes. Ensure the individual has access to this PRIOR to commencing the LRD. It is important to note that some insulins listed in Table 2 may not be available in all jurisdictions and therefore the list is not exhaustive and is subject to change depending on the availability of insulin where clinicians practise.

4.2.2 | Peri-operative management

Follow the latest local/national available guidelines which form the standard accepted management of people with diabetes undergoing surgery. For example, the latest CPOC Guidelines.[5]

The guidelines recognise the increasing use of GLP-1 based therapies and SGLT2 inhibitors in clinical practise. We advise continuing GLP-1 based therapies before metabolic-bariatric surgery to maintain peri-operative glycaemic control. The recent consensus statement of the Association of Anaesthetists, Association of British Clinical Diabetologists, British Obesity and Metabolic Surgery Society, CPOC, Joint British Diabetes Societies for Inpatient Care (JBDS-IP), Royal College of Anaesthetists, Society for Obesity and Bariatric Anaesthesia and UK Clinical Pharmacy Association included specific recommendations for the peri-operative management of patients taking GLP-1 based therapies to avoid pulmonary aspiration.[9]

4.2.3 | Post-operative/discharge management

There is no 'one size fits all' approach. All individuals with diabetes, irrespective of treatment modality, should be reviewed/discussed with the metabolic-bariatric

TABLE 2 Type 2 diabetes—Insulin-based therapy agents during the liver reduction diet (LRD).

Class of medication	(not exhaustive list)	Action
Basal insulin regimens	Abasaglar® (once or twice daily), Humulin-I® (once or twice daily), Insulatard® (once or twice daily), Lantus® (once or twice daily), Levemir® (once or twice daily), Semglee® (once or twice daily), Toujeo® (once daily), Tresiba® (once daily)	Reduce the total daily insulin dose by 50% at start LRD. May need optimisation Consideration should be given to the overall glycaemic control and insulin requirements which govern dose adjustment to optimise glycaemic control
Premixed insulin regimens	Humalog Mix25®, Humalog Mix50®, Humulin M3®, Novomix 30®	Reduce the total daily insulin dose by 50% at start LRD. May need optimisation Consideration should be given to the overall glycaemic control and insulin requirements which govern dose adjustment to optimise glycaemic control **If using premixed preparation of insulin three times daily:** Stop mid-day dose of premixed insulin and reduce all other doses as above
Basal-bolus insulin regime	Mealtime Actrapid®, Admelog®, Apidra®, Fiasp®, Humalog®, Humulin-S®, Lyumjev®, Novorapid®, Trurapi® In addition to basal insulins: Abasaglar® (once or twice daily), Humulin-I® (once or twice daily), Insulatard® (once or twice daily), Lantus® (once or twice daily), Levemir® (once or twice daily), Semglee® (once or twice daily), Toujeo® (once daily), Tresiba® (once daily)	Reduce basal insulin by 50% at start LRD. May need optimisation Depending on the carbohydrate intake, consider holding fast-acting mealtime insulin or reduce dose by 50% Consideration should be given to the overall glycaemic control and insulin requirements which govern dose adjustment to optimise glycaemic control

and diabetes teams. All individuals with diabetes on sulfonylurea, meglitinides or insulin therapies are at an increased risk of hypoglycaemia. Therefore, they must have access to and knowledge of how to perform blood glucose monitoring and manage hypoglycaemia. Peri-operative metabolic bariatric team should check this with the individual with diabetes.

4.2.3.1 | *Oral and non-insulin-based therapies following metabolic-bariatric surgery*

1. Record capillary blood glucose a minimum of 4 times daily during the inpatient stay.
2. If the pre-operative HbA1c is 58–69 mmol/mol (7.5%–8.5%) and post-operative capillary glucose levels are <11.1 mmol/L, then immediate-release metformin (not modified-release) can be restarted.
3. If the pre-operative HbA1c is <58 mmol/mol (<7.5%) then the pre-operative medication may be discontinued.
4. Of note, metformin tablets tend to be large and some may experience difficulty swallowing them. Metformin liquid or sachets may therefore be considered. Alternatively, consider switching modified release metformin to immediate release (standard) metformin (it is not possible to crush modified release metformin).
5. Table 3 summarises the general recommendations on the use of oral and non-insulin-based therapies after metabolic-bariatric surgery. It is important to note that the examples listed in Table 3 are not exhaustive, and are subject to change depending on the availability of medications where clinicians practise.[4]

4.2.3.2 | *Insulin therapy following metabolic-bariatric surgery for those with type 2 diabetes*

Individuals on insulin therapy should be discussed with and/or reviewed by the Diabetes-Bariatric Physician/Nurse. There is **no** set rule for insulin needs following metabolic-bariatric surgery.[4] Table 4 summarises insulin dose adjustments.

If the total daily dose of insulin required during the LRD/post-operatively is <10 units/day, then the insulin could be discontinued with guidance from the Diabetes-Bariatric Physician/Nurse:

- If discharged on insulin: blood glucose should be monitored 4 times daily and continue after discharge.
- If Insulin is not recommenced: blood glucose monitoring 4 times daily for 6 weeks.

Alternatively, teams could utilise a variable dose subcutaneous bolus insulin regime with rapid-acting insulin administration for type 2 diabetes following metabolic-bariatric surgery procedures to determine insulin requirements.

It is important to note that some insulins listed in Table 4 may not be available in all jurisdictions and therefore the list is not exhaustive and is subject to change depending on the availability of insulin where clinicians practise.

TABLE 3 Oral and non-insulin-based therapy agents following metabolic-bariatric surgery.

Class of medication	(not exhaustive list)	Action
Biguanide	Metformin	Can be restarted
Dipeptidyl peptidase-4 inhibitors	Alogliptin, Linagliptin, Saxagliptin, Sitagliptin, Vildagliptin	**Discontinue**. Can be restarted if there is a need to optimise glycaemic control or there is intolerance of metformin
Thiazolidinediones	Pioglitazone	**Discontinue**. Risk of weight gain, fluid retention
GLP-1 based therapies	Exenatide, Dulaglutide, Liraglutide, Semaglutide, (including Rybelsus®), Tirzepatide	**Discontinue**. May result in GI related side effects (nausea, vomiting). However, this could be restarted with diabetes team advice
Sulfonylureas	Glibenclamide, Gliclazide, Glimepiride, Glipizide	**Discontinue**. Risk of hypoglycaemia May be continued at a lower dose if post-operative glucose levels elevated. Discuss with diabetes team
Meglitinides	Repaglinide	**Discontinue**. Risk of hypoglycaemia May be continued at a lower dose if post-operative glucose levels elevated. Discuss with diabetes team
SGLT2 inhibitors	Canagliflozin, Dapagliflozin, Empagliflozin, Ertugliflozin	**Discontinue**. Risk of euglycaemic ketoacidosis Seek additional input from the diabetes team if there is an additional indication for the SGLT2i (e.g. chronic kidney disease, heart failure) and when to initiate again

Note: Rarely there may be a need to continue with additional non-insulin-based therapies in addition to metformin. In these circumstances other medications as described in Table 3 may be restarted.

TABLE 4 Insulin-based therapies following metabolic-bariatric surgery in type 2 diabetes.

Class of medication	(not exhaustive list)	Action
Basal insulin regimen	Abasaglar® (once or twice daily), Humulin-I® (once or twice daily), Insulatard® (once or twice daily), Lantus® (once or twice daily), Levemir® (once or twice daily), Semglee® (once or twice daily), Toujeo® (once daily), Tresiba® (once daily)	Reduce dose by 35–50% of pre-liver reduction diet (LRD) dose. Consider further reduction or discontinuation in those with type 2 diabetes. Consideration should be given to the individual's glycaemic control and insulin requirements which govern dose adjustment to optimise glycaemic control
Premixed insulin regimen	Humalog Mix 25®, Humalog Mix 50®, Humulin M3®, Novomix 30®	Reduce dose by 35%–50% of pre-LRD dose. Consider further reduction or discontinuation in those with type 2 diabetes. Consideration should be given to the individual's glycaemic control and insulin requirements which govern dose adjustment to optimise glycaemic control Consider switching to a once-a-day basal insulin to avoid potential hypoglycaemia risk
Basal-bolus insulin regimen	Mealtime Actrapid®, Admelog®, Apidra®, Fiasp®, Humalog®, Humulin-S®, Lyumjev®, Novorapid®, Trurapi® In addition to basal insulins: Abasaglar® (once or twice daily), Humulin-I® (once or twice daily), Insulatard® (once or twice daily), Lantus® (once or twice daily), Levemir® (once or twice daily), Semglee® (once or twice daily), Toujeo® (once daily), Tresiba® (once daily)	Reduce basal insulin dose by 35%–50% of pre-LRD dose. Consider further reduction or discontinuation of fast-acting mealtime insulin in those with type 2 diabetes. Consideration should be given to the individual's glycaemic control and insulin requirements which govern dose adjustment to optimise glycaemic control

4.2.4 | Further glycaemic management

The specialist metabolic-bariatric surgical MDT/GP/diabetes care provider should check HbA1c at 3, 6 and 12 months. In addition, individualised interpretation of HbA1c in the context of dynamic post-operative weight loss and dietary changes should be considered when escalating and deescalating glucose lowering therapies. It is also important to check for the occurrence and frequency of hypoglycaemia when conducting reviews in the post-operative phase for all individuals with diabetes on sulfonylurea, meglitinides or insulin therapies.

4.2.4.1 | *If previously on diet alone, or non-insulin based therapies*

- If HbA1c <48 mmol/mol (<6.5%), discontinue metformin (or other therapy).[10]
- If HbA1c ≥48 mmol/mol (≥6.5%), consider adding glycaemic therapy as per standard local or national type 2 diabetes management guidelines.[11]

4.2.4.2 | *If discharged with insulin therapy*

- If HbA1c <48 mmol/mol (<6.5%),[10] and total daily insulin dose <10 units/day, in those with type 2 diabetes consider insulin discontinuation with specialist diabetes input. Insulin should never be stopped in those with type 1 diabetes.
- If HbA1c ≥48 mmol/mol (≥6.5%), increase insulin/consider adding glycaemic therapy as per standard local or national type 2 diabetes guidelines with specialist diabetes input.[11]

4.2.4.3 | *If discharged and insulin therapy was discontinued*

- If HbA1c <48 mmol/mol (<6.5%), no action.
- If HbA1c ≥48 mmol/mol (≥6.5%), consider adding glycaemic therapy as per standard local or national guidelines.[11]

If type 2 diabetes remission is achieved following surgery, a recommendation should be made for an annual HbA1c and routine microvascular/macrovascular screening as this group is at high risk of type 2 diabetes relapse and complications. Remission can be defined when a person's HbA1c level is below 48 mmol/mol for at least 3 months without the use of glucose-lowering medications.[10] Ensure the type 2 diabetes remission is coded accordingly in electronic health records to ensure they continue to have annual assessments.

For those with type 2 diabetes and risk factors for (or existing) diabetes complications, ensure agents with added benefits of cardiovascular and renal protection are used (e.g. SGLT2 inhibitors). Reintroduction of GLP-1 based therapies may be appropriate for ongoing management of

glycaemic control, excess weight and cardiovascular risk. Seek specialist diabetes advice.

4.3 | Type 1 diabetes mellitus

Individuals with type 1 diabetes require review by the diabetes-bariatric physician. There is no set rule for individual insulin requirements following metabolic-bariatric surgery. The usual diabetes care providers must be contacted early to allow careful insulin management.

Individuals with type 1 diabetes **must not have their insulin discontinued**, as they will develop diabetic ketoacidosis (DKA). This may occur in up to 25% of cases following metabolic-bariatric surgery. Therefore, there is a need for:

a. Careful planning with the individual's diabetes team and review by the diabetes-bariatric physician.
b. Education relating to DKA avoidance and hypoglycaemia management to the individual with type 1 diabetes and staff.
c. The provision of a ketone testing kit and a form of continuous glucose monitoring (CGM). Liaise with the diabetes team.
d. Insulin doses need to be **tailored to the individual's needs**. This applies to the pre-operative LRD, peri-operative and post-operative periods.

4.3.1 | Insulin therapy during the LRD and following metabolic-bariatric surgery

The of LRD is supported in people with type 1 diabetes.[4] As mentioned, there is no set rule for insulin requirements during the LRD and following metabolic-bariatric surgery. Table 5 summarises recommended insulin adjustment during the LRD and following metabolic-bariatric surgery. It is important to note that some insulins listed in Table 5 may not be available in all jurisdictions and therefore the list is not exhaustive and is subject to change depending on the availability of insulin where clinicians practise.[4]

Individuals with type 1 diabetes need calories (and carbohydrate) to maintain insulin demands. A low-calorie diet can be harmful as it can induce ketone formation and acidosis. Therefore, there should be an adequate calorie (and carbohydrate) intake to maintain insulin needs (without insulin DKA will develop).

Consideration should be given to the overall glycaemic control and insulin requirements which govern dose adjustment to optimise glycaemic control and prevention of hypoglycaemia.

4.3.2 | Peri-operative management

Follow the local/national guidelines which form the standard accepted for management of diabetes in individuals undergoing surgery including timing of admission (same day or evening before) and use of variable rate intravenous insulin regimen (VRIII). Ensure long-acting insulin is given as usual and not omitted in the peri-operative phase to prevent diabetic ketoacidosis.[5]

For individuals using insulin pump/closed loop systems, follow the latest JBDS-IP guidelines on using technology to support diabetes care in hospital[12]:

- Stop the insulin pump, remove and store in a safe place.
- Ensure an alternative strategy for insulin delivery appropriate for major surgery as per the local/national protocols (e.g. VRIII). Ensure timely initiation of the alternative strategy upon cessation of subcutaneous insulin pump therapy.
- CGM readings should not be used to base treatment decisions.
- CGM sensors should be situated away from the operative site and the diathermy pad(s).

4.3.3 | Post-operative/discharge management

1. Aim to commence oral intake (shakes, etc.) at the earliest opportunity following metabolic-bariatric surgery so that a transition to subcutaneous insulin can be made.
2. Record capillary blood glucose at least four times daily during the inpatient stay and proactively prevent and manage hypoglycaemia.
3. Have a low threshold to check blood ketones if unwell or glucose >11 mmol/L.
4. All individuals with type 1 diabetes should be reviewed by the diabetes specialist team or the bariatric-diabetes physician prior to discharge from hospital.
5. Where an individual with type 1 diabetes is using an insulin pump or closed loop system, direction from the diabetes team on when and how to restart insulin pump therapy.
6. Ensure follow-up is arranged (or contact) with the local diabetes team on discharge.[13]

5 | AREAS OF UNCERTAINTY

1. Use of glucose monitoring technology and insulin pump therapy in the peri-operative and immediate post-operative phase.

TABLE 5 Insulin adjustment during the liver reduction diet (LRD) and following metabolic-bariatric surgery for individuals with type 1 diabetes.

Insulin regimen	(not exhaustive list)	Action
Basal insulin alone	Abasaglar® (once or twice daily), Humulin-I® (once or twice daily), Insulatard® (once or twice daily), Lantus® (once or twice daily), Levemir® (once or twice daily), Semglee® (once or twice daily), Toujeo® (once daily), Tresiba® (once daily)	It is very rare for people living with type 1 diabetes to be on basal insulin alone. Insulin doses should be titrated relative to blood glucose levels. It may be necessary to reduce dose by 30%–50% of pre-LRD dose **Do not stop insulin; risk of DKA**. Individuals with type 1 diabetes could liaise with diabetes teams to adjust further to achieve/maintain optimal diabetes control
Premixed insulin regimens	Humalog Mix 25®, Humalog Mix 50®, Humulin M3®, Novomix 30®	Insulin dose may need to be adjusted to 30%–50% of pre-LRD dose, consider further reductions as appropriate **Do not stop insulin; risk of DKA**. Individuals with type 1 diabetes could liaise with diabetes teams to adjust further to achieve/maintain optimal diabetes control
Basal-bolus insulin regime	Mealtime Actrapid®, Admelog®, Apidra®, Fiasp®, Humalog®, Humulin-S®, Lyumjev®, Novorapid®, Trurapi® Basal insulin: Abasaglar® (once or twice daily), Humulin-I® (once or twice daily), Insulatard® (once or twice daily), Lantus® (once or twice daily), Levemir® (once or twice daily), Semglee® (once or twice daily), Toujeo® (once daily), Tresiba® (once daily)	Insulin dose may need to be adjusted to 30%–50% of pre-LRD dose, consider further reduction as appropriate. The premeal insulin may need careful adjustment **Do not stop insulin; risk of DKA**. Individuals with type 1 diabetes could liaise with diabetes teams to adjust further to achieve/maintain optimal diabetes control
Insulin pumps and closed loop systems	Needs specialist diabetes input for an individualised care plan. Use the principles set in the JBDS-IP guidelines on using technology to support diabetes care in hospital.[12]	

2. How long to monitor glucose in individuals for whom insulin has been stopped post-operatively.
3. Planning the peri-operative phase in individuals using weekly insulin.

6 | AUDIT STANDARDS

1. Proportion of referrals made to the obesity MDT/specialist metabolic-bariatric surgical MDT. Aim for >75%.
2. Details of diabetes diagnosis, related conditions, HbA1c, medications and other relevant information (as per the local or national guidelines[5]) are listed in the referral letter.
3. Ensure HbA1c is optimised to <69 mmol/mol (where it is safe to do so). Optimisation should start at the time of the initial referral.
4. At the start of the LRD, ensure relevant literature and advice on medication adjustments are provided to the individual with diabetes.
5. Follow the local/national standards for peri-operative care in individuals with diabetes.
6. For individuals with type 1 diabetes: insulin must never be stopped as this exposes them to the risk of DKA.
7. In the post-operative phase, ensure glucose monitoring and medications adjustments.
8. All individuals with diabetes who have undergone metabolic-bariatric surgery should be reviewed by the diabetes specialist team prior to discharge.
9. Ensure follow-up and contact are arranged with the local diabetes team on discharge.

ACKNOWLEDGEMENTS

We would also like to thank the service user representatives whose input has informed the development of these guidelines. With special thanks to Helen Briscoe, JBDS-IP administrator, for her support and help with this and the JBDS-IP guidelines and activities.

FUNDING INFORMATION

The authors have nothing to report.

CONFLICT OF INTEREST STATEMENT

JWS, KD, AJM, NR, GNB, RCD and OGM declare no conflicts of interest. DJP declares consulting fees from Johnson & Johnson, Novo Nordisk, Eli Lilly, Pfizer, GSK and Medtronic as well as honoraria from Johnson & Johnson, Medtronic, Sandoz and Novo Nordisk. ADM has received research funding from the European Union,

Medical Research Council (MRC), National Institute for Health and Care Research (NIHR), HSC R&D division, Jon Moulton Charitable Foundation, Anabio, Fractyl, Boehringer Ingelheim, Eli Lilly, Gila, Randox and Novo Nordisk. ADM has received honoraria for lectures and presentations from Novo Nordisk, AstraZeneca, Currax Pharmaceuticals, Boehringer Ingelheim, Screen Health, GI Dynamics, Algorithm, Eli Lilly, Ethicon and Medtronic. ADM is a shareholder in the Beyond BMI clinic, which provides clinical obesity care.

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How to cite this article: Stephens JW, Dhatariya K, Beamish AJ, et al. Diabetes management in people undergoing metabolic-bariatric surgery: A guideline from the Joint British Diabetes Societies for Inpatient Care (JBDS-IP) Group. *Diabet Med*. 2026;43:e70281. doi:10.1111/dme.70281