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Abbreviations:

CBG	Capillary blood glucose
CGM	Continuous glucose monitor
CSII	Continuous subcutaneous insulin infusion
DKA	Diabetic ketoacidosis
DrEaMing	Drinking eating and mobilising
DSN	Diabetes specialties nurse
ER	Enhanced recovery
FRIII	Fixed rate intravenous insulin infusion
HHS	Hyperosmolar Hyperglycaemic State
JBDS	Joint British Diabetes society
SDM	Shared decision-making
VRIII	Variable rate intravenous insulin infusion

Introduction

The aim of this guideline is to improve the standards of care for people with diabetes undergoing operative or investigative procedures requiring starvation.

The Centre for Perioperative Care, CPOC, working in partnership with Diabetes UK, has now published guidance for the care of people with diabetes undergoing elective and emergency surgery that encompasses the whole perioperative pathway.

This guideline is a summary of the national guideline published by the Joint Diabetes Society in January 2023, the full document can be found at: [Surgical CPOC-Diabetes-Guideline-Updated2022.pdf \(amazonaws.com\) \(1\)](#).

Delivering whole pathway, quality perioperative care requires multicomponent intervention, with integration across primary, secondary and social care from the moment surgery is contemplated through to full recovery (See Appendix for flowcharts).

Diabetes Specialist Team

- Danielle Bruce Perioperative DSN (Mon-Fri 8am-4pm): Phone Number-07483168655
- There is an Inpatient Diabetes Specialist Nurse (DSN) service available (Mon-Fri 9am-5pm, 7 days at LRI site) to review inpatients – refer electronically via ICE (patient will be seen within 24 hours of receiving referral as long as this falls within normal working hours) or call the 'Diabetes Nurse Helpline' on x 14919 (Mon – Fri 9am- 5pm)
- Diabetes SpR on-call via LRI switchboard (Mon-Fri 9am-5pm).
- If advice is required out of hours please contact the Medical SpR on call via switchboard.

1. Summary of Surgical outpatient team recommendations:

Surgical teams should:

- Identify people with suboptimal diabetes management (HbA1c >69mmol/mol,8.5%) and refer to a specialist team for preoperative planning and optimisation

- Take both the urgency of the procedure and control of and management of diabetes into account to inform the timing of surgery (for example delaying surgery to optimise diabetes management)
- Try to minimise fasting for people with diabetes e.g first on the list.
- Provide written information about perioperative diabetes management (including a medicine management plan) within the patient’s surgical care pathway document.
- Ensure use of Enhanced Recovery (ER) programmes
- Make Every Contact Count; use consultation as a teachable moment and discuss lifestyle modification that is proven to have perioperative and long-term benefit:

exercise	weight management	psychological preparation
importance of good nutrition	smoking cessation	reduction in alcohol

2. Summary of recommendations for staff working in preoperative assessment services

Preoperative assessment clinic staff should:

- Document type of diabetes, usual diabetes medications, HbA1c level (within three months) and evidence of end organ damage. For example autonomic neuropathy causing postural hypotension, renal impairment increasing the risk of acute kidney injury (AKI), and/or peripheral vascular disease increasing the risk of heel or pressure ulcers, etc.
- Refer to the diabetes specialist team if HbA1c >69mmol/mol (8.5%) or if on an insulin pump/CSII
- Be aware of newer methods of diabetes management:
 - People with Type 1 diabetes are being managed with **CSII**. This can be safely used in theatre provided certain criteria are met. Shared decision-making needs to occur if the use of the insulin pump is contemplated. This should only be performed by people knowledgeable in both shared decision making (SDM) and the safe use of the CSII in hospital (**See Section 12**)
 - **CGM/flash devices** – people with diabetes may continue to use their own sensors but clinicians need to be aware of the lag shown in flash devices and the consequent need to take CBG at regular intervals during surgery to allow accurate and optimal management.

- Pre-prescribe diabetes medication prior to admission. Insulin should be prescribed in accordance with NPSA recommendations for safe use of insulin. (see table 1-4 for insulin and table 5 for non-insulin medication.)
- Pre-prescribe rescue treatment for **looming hypoglycaemia** (for example for glucose levels between **4–6mmol/l**), **hypoglycaemia** (see section 5)
- Be aware that for many optimally managed people with diabetes using continuous sub-cutaneous insulin infusion and/or wearable glucose sensors, a range of 4–6mmol/l may be their normal level when they are not eating. In these cases it is important to have a discussion with the person with diabetes about the need to avoid severe hypoglycaemia and therefore the need to aim for higher levels than they are used to
- Encourage the person with diabetes to bring all of their medication into hospital to ensure that they can continue to use familiar medication and to avoid omitted doses
- Provide Diabetes Passport (with individualised care plan), written and shared with the person with diabetes, visible to the perioperative team (including the surgeon, anaesthetist, ward team), including:
 - Instructions regarding necessary changes to medication prior to admission, using hospital approved protocols (Table 1-3)
 - Instructions for the person with diabetes on how to seek advice if required during their admission
 - Instruction for the person with diabetes on what to bring to hospital and a list of common things to consider
 - Explicit documentation on whether a VRIII is required and for how long.
 - Location of surgery (day case surgery, admission on day of surgery or prior, with rationale documented)
 - Timing of surgery (ideally first or first 1/3rd of morning list and not on an evening list)
 - A discharge plan including potential need for formal and informal social care, community care and primary care team.
- Identify other co-morbidities that often coexist with or occur as a consequence of diabetes and refer to the relevant teams for optimisation where necessary
- We don't recommend carbohydrate loading in patients with diabetes due to its adverse impact on post-operative blood glucose levels leading to increased risk of complications.

Perioperative adjustment of Insulin:

Due to the potential for insulin preparations to change, this table is for guidance only and reference should be made to the UKCPA Handbook of Perioperative Medicines for up-to-date information <https://www.ukcpa-periophandbook.co.uk/>

Table 1:

Long acting insulins:				
Insulins	Example	Day prior to admission	Patient for AM surgery	Patient for PM surgery
Once daily long acting (morning)	Abasaglar Humulin I Insulatard Hypurin Porcine Isophane Lantus Levemir Semglee Tresiba Toujeo Xultophy	No dose adjustment necessary	Give 80% of dose and blood glucose to be checked on admission	Give 80% of dose and blood glucose to be checked on admission
Once daily long acting (lunchtime)	As above	Give 80% of dose	Restart insulin at normal dose when eating and drinking starts.	Restart insulin at normal dose when eating and drinking starts
Once daily long acting (evening)	As above	Give 80% of dose	No dose adjustment necessary	No dose adjustment necessary
Twice daily (long acting insulin)	As above	Morning dose will need to stay the same and evening dose will be to be 80%	Morning dose will need to be 80% and blood glucose to be checked on admission. Evening dose will remain unchanged	Morning dose will need to be 80% and blood glucose to be checked on admission. Evening dose will remain unchanged

Table 2:

Premixed Insulin prepared by manufacturers				
Insulins	Example Medications	Day prior to admission	Patient for AM surgery	Patient for PM surgery
Twice Daily	Humulin M3	No dose adjustment	Halve usual morning	Halve usual morning

	Humalog Mix 25 Humalog Mix 50 Hypurin Porcine 30/70 Mix Novomix 30	necessary	dose. Blood glucose to be checked on admission. Resume usual insulin with evening meal if eating a normal meal. If eating half/small meal give half usual dose. If not eating give basal only component of the usual mixed insulin.	dose. Blood glucose to be checked on admission. Resume usual insulin with evening meal if eating a normal meal. If eating half/small meal give half usual dose. If not eating give basal only component of the usual mixed insulin.
Three times per day	As above	No dose adjustment necessary	Halve usual morning dos. Blood glucose to be checked on admission. Omit lunchtime dose Resume normal insulin with evening meal if eating a normal meal. If eating half/small meal give half usual dose. If not eating give basal only component of the usual mixed insulin.	Halve usual morning dos. Blood glucose to be checked on admission. Omit lunchtime dose Resume normal insulin with evening meal if eating a normal meal. If eating half/small meal give half usual dose. If not eating give basal only component of the usual mixed insulin.

Table 3:

Self Mixed Insulin prepared by patient/carer				
Insulins	Example Medications	Day prior to admission	Patient for AM surgery	Patient for PM surgery
Twice daily (two different types of insulin combined by the person with diabetes into one injection)	Short acting: Actrapid Apidra Fiasp Humalog Humulin S Hypurin Porcine Neutral Lyumjev NovoRapid Trurapi AND	No dose adjustment necessary	Calculate the total dose of both morning insulins and give half of this total dose as intermediate acting insulin only in the morning Blood glucose to be checked on admission Resume usual insulin with evening meal if	Calculate the total dose of both morning insulins and give half of this total dose as intermediate acting insulin only in the morning Blood glucose to be checked on admission Resume usual insulin with evening meal if

	intermediate acting: Humulin I Hypurin Porcine Isophane Insulatard		eating a normal meal. If eating a half/small meal give half usual dose. If not eating give basal only component of the usual mixed insulin.	eating a normal meal. If eating a half/small meal give half usual dose. If not eating give basal only component of the usual mixed insulin.
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Table 4:

Short acting Insulin				
Insulins	Example medications	Day prior to admission	Patient for AM surgery	Patient for PM surgery
Short acting insulin with meals (2-4 doses a day)	Actrapid Apidra Fiasp Humalog Humulin S Hypurin Porcine Neutral Insuman Rapid Lyumjev NovoRapid Trurapi	No dose adjust	Omit morning dose if no breakfast is eaten Blood glucose to be checked on admission. Omit lunchtime dose if not eating and drinking normally. Resume normal insulin with evening meal if eating a normal meal.	Take your usual morning insulin dose with your breakfast Omit lunchtime dose if not eating. Blood glucose to be checked on admission. Resume normal insulin with evening meal if eating a normal meal.
Resume taking usual insulin the morning after surgery (procedure). However, blood glucose levels may be higher than usual for a day or so.				
VRIII	Dose of long-acting insulin should be 80% Short acting, intermediate and pre-mixed insulins should be discontinued and replaced by long acting basal insulin at a dose of 0.2 units per kilogram. A return to the person's usual diabetes management should be made one they are eating and drinking normally. Adjustments may need to be made to insulin dose(s) as insulin requirements may change in the post-operative period – blood glucose levels should be monitored and advice sought from the specialist diabetes team if necessary.			

Table 5: Perioperative adjustment of non-insulin diabetes medication before surgery:

Non-insulin diabetes medication			
Diabetes medication	Day prior to admission	Timing of surgery	
		Patient for AM surgery	Patient for PM surgery
Acarbose	Take as normal	Omit morning dose if not eating	Give morning dose if eating
Meglitinide (repaglinide or nateglinide)	Take as normal	Omit morning dose if not eating	Give morning dose if eating
Metformin (AND eGFR>60ml/min/1.73m2 or procedure not requiring use of contrast media)	Take as normal	If taken once or twice a day – take as normal If taken three times per day, omit lunchtime dose.	If taken once or twice a day – take as normal If taken three times per day, do not take lunchtime dose
Sulphonylurea (e.g glibenclamide, gliclazide, glipizide, glimiperide)	Take as normal	Omit on morning of surgery. If taken twice daily, take evening dose if eating	Do not take on day of surgery
Pioglitazone	Take as normal	Take as normal	Take as normal
DPP4 inhibitor (e.g sitagliptin, vildagliptin, saxagliptin, alogliptin, linagliptin)	Take as normal	Take as normal	Take as normal
GLP-1 Receptor Agonist * (eg exenatide, liraglutide, lixisenatide, dulaglutide, semaglutide) Daily/Weekly administration	Take as normal	Take as normal	Take as normal
SGLT-2 inhibitors (dapagliflozin, canagliflozin, empagliflozin)**	Omit 3 days before surgery***	Omit on day of surgery	Omit on day of surgery
* Prudent precautions should be undertaken to avoid pulmonary aspiration. Tirzepatide is a newer long-acting GIP receptor & GLP-1 receptor agonist. Guidance is as above (see GLP-1 RA)			
**Ertugliflozin has longer half-life and to be stopped at least 4 days before surgery.			
***Three day omission is advocated to reduce the risk of euglycaemic diabetic ketoacidosis (EuDKA)/Diabetic ketoacidosis (DKA) with SGLT2i use. This is the current UHL consensus. This is an evolving area and duration of omission will be revisited as we gather more data/evidence. Longer periods of treatment cessation are advocated in certain patient groups and, in general, should coincide with the start of reduced food intake (See section below on SGLT2i). <u>For Emergency procedures:</u> Withhold SGLT-2 inhibitors on admission to hospital. Check ketones (Page 10)			
Note: SGLT-2 inhibitors have been approved for extra-glycaemic indications for the treatment of chronic heart failure and for CKD in adults with and without type 2 diabetes. The risk of EuDKA in SGLT2i use in people without diabetes is low. Recent guidelines from the ESC (endorsed by the ESAIC), are unclear as to whether they support discontinuation of SGLT2 inhibitors before surgery only in patients with diabetes mellitus or in all patients. In view of emerging case reports of EuDKA, it is advisable to consider temporarily discontinuing of SGLT2i, as above, in clinical situations known to predispose to ketoacidosis to minimise this risk. For combination products containing metformin, please refer to individual monograph			

Sodium-glucose co-transporter-2 Inhibitors (SGLT-2 Inhibitors)

SGLT-2 inhibitors lower blood glucose concentrations independent of insulin by inhibiting urine glucose reabsorption in the proximal tubule in the kidney and promote glucose excretion. Over the last few years, there has been an increasing number of reports of patients with type 2 diabetes treated with these medications who develop severe acidosis during the perioperative period. In 2020, a safety label for SGLT-2 inhibitors was changed to recommend withholding them for a longer period before surgery. There is risk of diabetic ketoacidosis (DKA)/ Euglycaemic DKA (EuDKA), if continued along with risk of volume depletion, hypotension and / or electrolyte disturbances if continued.

Predisposing factors for EuDKA: Surgical/procedure associated stress, dehydration (fasting), reduced carbohydrate intake (fasting), concurrent illness, including infections, alcohol intake.

Elective surgery:

Current guidance suggests that SGLT-2i should be interrupted in people with diabetes who have been hospitalised for major surgery or acute serious illness. There duration of treatment cessation is under review. Please visit <https://www.ukcpa-periophandbook.co.uk/medicine-monographs/sodium-glucose-co-transporter-2-sgl-2-inhibitors> for updates in this area.

When to STOP:

At UHL, we recommend stopping canagliflozin, dapagliflozin, and empagliflozin for at least 3 days to reduce the risk of perioperative euglycemic ketoacidosis in diabetic patients.

Longer period of treatment cessation may be necessary and, in general, should coincide with the reduced food intake.

- In T2DM *patients undergoing Bariatric Surgery* on Liver Reduction Diet (LRD). Most people needing bariatric surgery have a large, fatty liver which can cause difficulty for laparoscopic surgery, as the stomach cannot be easily accessed. The LRD typically start 10 – 15 days prior to bariatric surgery and is based on low calories, in particular low carbohydrate, and fat. This forces stored glycogen to be released from the liver (plus some water), making it softer, more flexible and easier to move. Due to the reduced calorie and carbohydrate intake, CBG levels will most likely be reduced. In addition, weight loss itself stimulates ketone production and can increase the risk of euglycaemic DKA developing. Therefore, SGLT-2 inhibitors should be discontinued at the start of the LRD.
- *Other Patients who require reduced calorie intake prior to their procedure (e.g., those who require pre-operative bowel preparation)*, longer period of treatment cessation may be necessary and, in general, should coincide with reduced food intake. Blood

Glucose and Ketone levels. Measure capillary blood ketones daily if the person with diabetes is normally on SGLT2 inhibitors (gliflozins) even if glucose concentrations are normal.

Patients who inadvertently take their SGLT2i prior to planned procedures:

Cases where high interventional stress may be expected and/or where a prolonged fasting state is expected in the peri-procedure period (>12 hours) there is increased risk for EuDKA due to decreased glycogen stores. Hence elective procedures should be cancelled/postponed if SGLT2i medication is taken inadvertently (within the recommended omission period) where a prolonged fasting state is expected in the peri-procedure period. Exceptions may include patients undergoing short (<45 minutes) very low risk procedures where post-procedural oral intake can occur sooner and where a procedure is deemed by the clinical team to be urgent enough to proceed (10). Ensure blood ketone and basic metabolic panel (check anion gap and bicarbonate, pH) is performed. Close monitoring for EuDKA is recommended and appropriate lab work should be obtained pre and post procedure.

- If the ketone level is <1.5 mmol/L, then the procedure can continue as scheduled.
- If the ketone level is ≥ 1.5 mmol/L but <3.0 mmol/L, then further workup with an anion gap (AG) /pH can clarify the extent of metabolic derangement:
 - If the pH is <7.3 (or AG >14) then the procedure should be cancelled and the patient should be sent to the nearest emergency department/AMU or seen by diabetes team for further evaluation.
 - pH is ≥ 7.3 , then the procedure can continue as scheduled with close monitoring and early postoperative oral intake. See indications for VRIII.
- If the ketone level is ≥ 3.0 mmol/L, do VBG. If in DKA, (Bicarbonate (HCO_3^-) < 15.0 mmol/L and / or venous pH < 7.3), refer to trust DKA policy (2) for management.
- For hospitalised patients and procedures >4 hours in duration, a blood ketone level and/or anion gap should be repeated post procedure

When to restart:

Sodium-glucose co-transporter 2 (SGLT2) inhibitor therapies improve blood glucose control and also has proven cardio-renal benefits. Restart SGLT2i when patient is,

- Eating and drinking normally
- Any volume depletion has been corrected, VRIII (where applicable) has been stopped,
- Ketone levels are normal and
- Medically stable.

Once restarted check blood ketones daily whilst an inpatient, even if CBG is normal.

In those undergoing Bariatric Surgery, due to increased risk of dehydration and overall improvement of glycaemic control due to weight loss, discontinuation of SGLT-2 inhibitors should be considered after surgery. Blood glucose should be monitored until eating habits and food intake stabilises. Patients should have their need for on-going pharmacological management of their diabetes reviewed by their General Practitioner / Bariatric Surgical Team.

Emergency Surgery:

When to STOP:

Withhold SGLT-2 inhibitors on admission to hospital.

Monitoring:

Ensure SGLT 2 inhibitors are withheld and daily ketone levels checked throughout admission.

Prioritise surgery to minimise duration of fasting.

Use VR111 as per policy (section 4). See section 7 for guidance on Emergency surgery.

Refer to Perioperative DSN / diabetes team or physicians if there is:

- metabolic derangement
- recurrent or severe hypoglycaemia.
- persistent hyperglycaemia (two or more consecutive BG values >13mmol/l or hyperglycaemia with ketone levels >1.5mmol/l).

When to restart:

Restart when SGLT2i when patient is,

- Eating and drinking normally
- Any volume depletion has been corrected, VR111 (where applicable) has been stopped,
- Ketone levels are normal and
- Medically stable.

Once restarted check blood ketones daily whilst an inpatient, even if CBG is normal.

3. Summary of recommendations for staff delivering care during hospital admission for elective surgery

Ward staff should:

- check that any pre-prescription of medication (from preoperative assessment clinic) is consistent with medication prescribed at admission
- ensure medication is prescribed with adjustments (see above) as instructed by preoperative assessment services
- ensure rescue medication is prescribed to allow prompt treatment of looming hypoglycaemia and hyperglycaemia
- document an agreed plan for people with diabetes who are using CSII and those using subcutaneous sensor devices
 - monitor CBG regularly and aim keep in the range 6–10mmol/l (up to 12mmol/l is acceptable)
 - for those treated with dietary modification alone, or oral glucose lowering medications which do not cause hypoglycaemia for example, metformin or DPP4 inhibitors (gliptins), the Joint British Diabetes Society (JBDS) recommend an acceptable blood glucose range of **4–12mmol/l**.
 - In the majority of people with diabetes on glucose lowering medication (any insulin preparation and any insulin secretagogues), consider intervening at a CBG of <6.0mmol/l to prevent hypoglycaemia. This may require oral or intravenous carbohydrate. However, for many optimally managed people with diabetes using pumps and/or wearable glucose sensors, a range of 4–6mmol/l may be their normal when they are not eating. In these cases the decision as to whether to intervene at a blood glucose of <6mmol/l or <5mmol/l should be a joint decision
- measure capillary blood glucose levels if the person with diabetes become unwell or has persistent hyperglycaemia (2 or more readings above 13mmol/l)
- measure capillary blood ketones **daily** if the person with diabetes is normally on **SGLT2 inhibitors** (gliflozins) even if glucose concentrations are normal (as these medications can be associated with euglycaemic ketosis, EuDKA). See section on SGLT2i, page 12.
- inspect foot and pressure areas regularly
 - ensure ER programmes are followed for all patients, including those with diabetes

4. Variable rate insulin infusion

- The aim is to maintain glucose level within the target of **6-10mmol/l** (up to 12mmol/l may be acceptable).
- There is no one fit for all
- VRII is preferred method to managing the surgical patients glucose levels in the following circumstances:
 - Missing more than one meal
 - Type 1 diabetics who have not received their background insulin
 - HbA1c>69mmol/mol (>8.5%)
 - Most people requiring emergency surgery (See Table 7)
 - Persistent hyperglycaemia (CGB >12mmol/l)
- If the person with diabetes is already on a long acting insulin analogue (eg Levemir[®], Lantus[®] or Tresiba[®]) these should be continued at 80% of the usual
- Insulin infusion rate should be determined by the bedside CBG
- Hourly CBG should be taken – initially for the first 12 hours
- If CBG remains above 12mmol/l for 3 consecutive readings and is not dropping by 3mmol/l or more the rate of the insulin should be increased.
- the low glucose level should be treated as per the national guidelines for management of hypoglycaemia.
- **In people with Type 1 DM, the VRIII must never be stopped until alternative subcutaneous insulin has been administered in the previous 30 minutes.**

Setting up a variable rate intravenous insulin infusion

- a) Intravenous fluid must be administered using a volumetric infusion pump.
- b) Delivery of the solution containing glucose, sodium and potassium (see section 5 on choice of fluid) alongside the VRIII and the VRIII must be via a single cannula with appropriate one- way and anti-siphon valves.
- c) Set the fluid replacement rate to deliver the hourly fluid requirements of the individual patient
- d) Insulin must be administered via a syringe pump.

e) Insulin should not be administered without glucose containing fluid as above except on senior advice in an ITU/HDU setting.

f) Insulin must be infused at a variable rate to keep the blood glucose 6-10 mmol/L (acceptable range 6-12 mmol/L).

g) Continue the solution containing- glucose, sodium and potassium- alongside the VRIII intra-operatively and post-operatively until the patient is eating and drinking and back on their usual glucose lowering medication.

h) Additional fluid therapy may be required according to the specific needs of the patient for a given surgical procedure. Hartmann's solution is acceptable alongside substrate as is 0.9% sodium chloride. Ideally the post-operative sodium intake should not exceed 200 mmol/day.

Plasmalyte can be added to this as an alternative fluid which can be given.

i) If the insulin and solution containing glucose, sodium and potassium alongside the VRIII are disconnected from the patient new solutions and new giving sets should be used to reduce the risk of nosocomial infection.

5. Fluids to run alongside VRII

It is recommended that **5% Glucose in 0.45% saline and 0.15%/0.3% potassium chloride** should always be run alongside the VRIII at a rate to meet the patient's fluid maintenance requirements.

It is acknowledged that not all surgical wards and theatres will have access to this solution. In these circumstances **4% glucose in 0.18% saline and 0.15%/0.3% potassium chloride can be used instead**. However, daily assessment of serum electrolytes is mandatory and resultant hyponatraemia must be treated appropriately.

Table 6: Suggested scales for insulin infusion rate

INTRAVENOUS INSULIN INFUSION: Using an insulin syringe draw up 50 units of human soluble insulin (e.g Actrapid) and add to 49.5ml of 0.9% sodium chloride to give a 1 unit/ml solution or use a prefilled syringe 50 units Actrapid in 50ml where available. Use a 50ml syringe pump to administer.

Additional Instructions	Capillary Blood Glucose (CBG)	Scale 1 Units/hr	Scale 2 Units/hr	Scale 3 Units/hr	Revised scale Units/hr
		Use if daily insulin requirements \leq 30 units	Use if daily insulin requirements >30-60 units	Use if daily insulin requirements >60 units	Use if individualised scale is required
STOP VRIII Treat hypo as per policy. Reduce VRIII scale to insulin sensitive regime. Start VRIII once CBG>4. Ensure glucose containing fluid is prescribed and administered. If HYPOGLYCAEMIA occurs on VRIII, stop VRIII treat hypoglycaemia as policy, reduce VRIII scale to 'insulin sensitive' regime, restart VRIII once CBG >4mmols/L, ensure glucose containing fluid is prescribed and administered.	<4.0	0	0	0	
In patients with diabetes undergoing surgery and in specific medical patient groups (e.g., frailty, acute stroke) where target CBGs 6-10, STOP VRIII when CBG<6, treat 'looming hypo*' as per policy. Recheck CBG. Restart VRIII when CBG>6, Ideally within 10-15 minutes.	4.1 - 6.0	0.2	0.5	0.5	
	6.1 - 8.0	0.5	1	2	
	8.1 - 12.0	1	2	4	
	12.1 - 16.0	2	4	6	
	16.1 - 20.0	3	5	7	
	20.1 - 24.0	4	6	8	
	>24.1	6	8	10	
Check glucose hrly					
Date					
Signature					

5. Looming Hypoglycaemia and Hypoglycaemia

- Looming hypoglycaemia is defined as a CBG in the region of **4–6mmol/l** in a person with diabetes on glucose lowering medication.
- It is now recognised that aiming for tight glycaemic management (CBG 4–6mmol/l) in unwell people with diabetes, especially if the person is on medication that actively lowers blood glucose, may cause hypoglycaemia.
- Adults with CBG >4 and <6mmol/l who are on glucose lowering medication (insulin and insulin secretagogues) consider managing looming hypoglycaemia by combination of: adjusting insulin, administration of glucose, snack if not nil by mouth (aiming for 15g of carbohydrate, eg one slice of toast. If a person with diabetes is nil by mouth IV glucose and buccal glucose gel 40% are the preferred treatments
- Adults with hypoglycaemia (CBG, 4.0 mmol/l) who conscious, orientated and able to swallow

1) Give 15–20g quick acting carbohydrate of the person with diabetes choice where possible. Some examples are:

- five to seven Dextrosol® tablets
- one bottle (60ml) Glucojuice® or LIFT juice shots
- 100ml of 20% glucose over 10-15 minute

2) If NMB IV glucose and oral glucose gel is preferred

3) Repeat CBG 10-15mins later, if less than 4mmol/l repeat step 1.

4) If a person with diabetes has hypoglycaemia or looming hypoglycaemia after 30–45 minutes or three cycles, contact the ward doctor. Consider:

- 1mg of glucagon IM
- 150–200ml of 10% glucose over 15 minute

5) Once the person with diabetes has recovered, offer a long-acting carbohydrate of the person's choice where possible (except if nil by mouth)

6) People with diabetes who self-manage their insulin pumps (CSII) may not need a long-acting carbohydrate but should take initial treatment as outlined and adjust their pump settings appropriately.

7) If the hypoglycaemia was due to sulfonylurea or long-acting insulin therapy then be aware that the risk of hypoglycaemia may persist for up to 24–36 hours.

8) Ensure regular capillary blood glucose monitoring is continued for at least 24 to 48 hours

9) Refer to trust Hypoglycaemia policy for full guidance

6. Perioperative Hyperglycaemia and management

Key causes of perioperative hyperglycaemia (CBG >12mmol/l)

1. Hospital acquired Diabetic Ketoacidosis (DKA) (3)
2. Hyperosmolar Hyperglycaemic State (HHS) (4)
3. Stress hyperglycaemia
4. Insufficient medications for example omission of insulin, disconnection/blockage of CSII.

5. Sepsis/infection

Check ketone. Rule out diabetes emergencies. Refer to Trust DK/HHS/Hyperglycaemia policies. If no evidence of DKA or HHS, consider correction dose of subcutaneous rapid acting analogue insulin (like Novorapid or Trurapi). If recurrent hyperglycaemia, consider need for variable rate intravenous insulin infusion if fasting or for dose adjustment of medication or commencement of insulin

Insulin correction doses for people with Type 1 diabetes

- Give subcutaneous rapid acting analogue insulin. Assume that one unit will drop blood glucose by 3mmol/l, but wherever possible take advice from the person with diabetes about the amount of insulin normally required to correct a high blood glucose.
- Recheck the blood glucose one hour later to ensure it is falling. Repeat the subcutaneous insulin dose after two hours if the blood glucose is still above 12mmol/l.
- Recheck the blood glucose after one hour. If it is not falling consider introducing VRIII.

Insulin correction doses for people with Type 2 diabetes

- Give 0.1 units/kg of subcutaneous rapid acting analogue insulin and recheck blood glucose one hour later to ensure it is falling.
- Repeat the subcutaneous insulin after two hours if the blood glucose is still above 12mmol/l.
- Repeat the blood glucose after 60-90 minutes. If it is not falling consider introducing VRIII.

7. Summary of recommendations for staff admitting people with diabetes as emergency surgical admissions

The primary aim in the management of people with diabetes presenting for emergency surgical assessment is to prevent and/or promptly diagnose metabolic derangements (hypoglycaemia, hyperglycaemia, DKA (both hyperglycaemic and euglycaemic) and hyperglycaemic hyperosmolar syndrome (HHS).

In addition to the recommendations above staff should:

- ensure all emergency admissions of people with diabetes have glycaemic status (CBG) and metabolic status (renal profile, lactate and ketones) and **HbA1c** documented. Early ED and senior surgical decision makers input to minimise period of fasting.

- ensure people with Type 1 diabetes have ketone levels checked and insulin prescribed (either basal insulin or intravenous insulin infusion). **Failure to prescribe insulin in people with Type 1 diabetes can result in fatal diabetic ketoacidosis**
- ensure early medicines reconciliation. Ensure **SGLT 2 inhibitors are withheld** and daily ketone levels checked throughout admission. See page 11.
- refer to diabetes team or physicians if there is metabolic derangement:
 - recurrent or severe hypoglycaemia.
 - persistent hyperglycaemia (two or more consecutive BG values >13mmol/l or hyperglycaemia with ketone levels >1.5mmol/l).
- prioritise surgery to minimise duration of fasting
- use VRIII according to **table 6** if the person with diabetes is fasting resulting in more than one missed meal
- use a fixed rate **intravenous insulin infusion** (FRIII) according to JBDS guidelines if the person with diabetes has DKA or HHS (2,3). Table 6.
- modify the person's normal insulin if the person with diabetes will be fasting for more than one missed meal.
- for any person with diabetes requiring VRIII consider the use of a reduced rate VRIII if any risk factors for hypoglycaemia present (chronic kidney disease, acute kidney injury, low body weight, low total daily dose of insulin, insulin naive)

Table 6: Initial diabetes management of the patient admitted as a surgical emergency

Type of diabetes	Type 1 DM	Type 2 DM and insulin dependent (+/-non-insulin glucose lowering medication)	Type 2 DM and on non-insulin anti-diabetes medication	Diet Managed type 2DM
Metabolic state				
Normoglycaemia (CBG <10 mmol/l) and no metabolic derangement	Modification if ≤1 missed meal VRIII if ≥1 missed meal	Modification if ≤1 missed meal VRIII if ≥1 missed meal	Modification and monitor CBG at least twice daily	Monitor CBG at least daily
Hyperglycaemia (CBG >10mmol/l)	VRIII	VRIII	VRIII	VRIII
Diabetic ketoacidosis* Be aware: mixed HHS and DKA can occur	FRIII	FRII	FRIII	FRIII
Hyperosmolar hyperglycaemic state (HHS)**	FRIII	FRIII	FRIII	FRIII
Important notes	Do not omit insulin Check CBGs regularly Check ketones if CBG >13 mmol/l Continue basal insulin at 80% of normal dose If prolonged fasting: Intermediate and Pre-mixed Insulins should be discontinued and replaced by a long acting basal insulin at a dose of 0.2 units per kilogram	Continue basal insulin at 80% of normal dose If prolonged fasting, Intermediate and Pre-mixed Insulins should be discontinued and replaced by a long acting basal insulin at a dose of 0.2 units per kilogram If on SGLT 2 inhibitors: stop them and check ketones daily Hold metformin if AKI and/or eGFR <30	If on SGLT 2 inhibitors: stop them and check ketones daily. Stop metformin if renal impairment	May require no specific intervention

Diabetic ketoacidosis (DKA) *= presence of diabetes with Ketones >3.0mmol/l and venous pH<7.3.

Hyperosmolar hyperglycaemic state (HHS)**=Glucose >30mmol/l and bicarbonate >15mmol/l, and pH >7.3, and osmolality >320 mOsm/kg

9. Summary of recommendations for staff in theatre and recovery

Staff in theatre and recovery should:

- Theatre and recovery area should have immediate access to a glucose meter, ketone meter, ‘hypobox’, rapid acting insulin and insulin syringes
- Ensure the contents of ‘hypobox’ are checked and if necessarily replenished daily
- Implement the WHO surgical safety checklist bundle with maintenance of intraoperative blood glucose levels between **6–12mmol/l**

- Check CBG prior to induction of anaesthesia, monitor and record the CBG at least hourly if on insulin, or insulin secretagogues, otherwise a minimum of two hourly is recommended
- Never stop an insulin infusion in a person with Type 1 diabetes unless basal subcutaneous insulin has been given, the glucose is <10mmol/l and ketones are <0.6mmol/l
- Ensure a planned approach to the use of CGM, continuous sub-cutaneous insulin infusion and closed looping systems
- Ensure preventative actions to avoid and/or manage pressure areas and diabetes related foot issues
- Utilise anaesthetic strategies to promote early return to usual diet and diabetes management including: Regional Anaesthesia, reducing PONV and multimodal analgesia
- Ensure a safe, documented handover from theatre recovery to the ward including:
 - medications given in theatre
 - CBG level on leaving the recovery area
 - plan for ward-based management of diabetes –e.g. duration of VRIII, sub-cut insulin 30mins prior to discontinuation of VRIII.
 - criteria for contacting the diabetes, anaesthetic or physician teams supporting postoperative care.

10. Summary for recommendations for teams delivering postoperative ward care

Ward teams should:

- Monitor and maintain CBG in target (6–12mmol/l) unless otherwise specified in care document
- Monitor electrolytes and fluid balance daily and correct accordingly. Check Ketones as appropriate.
- Proactively treat postoperative nausea and vomiting
- Promote restoration of usual diet and restoration of normal diabetes medications
- Never stop an insulin infusion in a person with Type 1 diabetes unless basal subcutaneous insulin has been given and ketones are <0.6mmol/l.
- Promote drinking, eating, mobilising (DrEaMing)
- Support the person with diabetes to resume self-management of diabetes as soon as possible

- Inspect pressure areas daily.

11. Summary of Recommendations for safe and effective discharge and follow up

Ensure a proactive planned approach to timely, safe and effective discharge. The ward team should ensure:

- A focus on discharge planning from time of admission
- Ensure ongoing review of discharge plans throughout the admission, aiming to proactively identify and address potential barriers to discharge
- Involve the diabetes specialist team if discharge delays are diabetes related (for example suboptimal diabetes management)
- Ensure timely communication with all services, community, primary and social care, involved with post-discharge patient care.
- This is particularly important if:
 - changes have been made to diabetes medications during the hospital stay
 - there are concerns regards management of diabetes
 - there has been prolonged postoperative dysglycaemia (12mmol/l) for more than 3 days.
- Provision of timely (day of discharge) written discharge documentation to the person with diabetes, and GP to include:
 - Sick day rules
 - Details on who to contact for advice regards to management of diabetes & post-surgical issues
 - Changes made to diabetes medications.

12. Perioperative use of wearable technology during elective procedures (Continuous subcutaneous insulin infusion CSII and Continuous glucose monitoring CGM and Hybrid closed loops)

Increasing numbers of people, particularly those with type 1 diabetes (T1D), are using wearable technology (11). It is important to be able to distinguish between the two main types: continuous glucose monitoring (CGM), insulin pumps (CSII) and Hybrid closed loops (Figure 1).

CGM can be real-time or intermittently scanned continuous glucose monitoring, also known as flash glucose monitoring. These devices measure interstitial glucose, and through smart technology, transmit glucose levels to a reader or smartphone app.

Insulin pumps (also known as CSII: “continuous subcutaneous insulin infusion”) are used by people with T1D to improve HbA1c and/or reduce the risk of hypoglycaemia. An insulin pump provides a continuous basal infusion of short acting insulin (the hourly rate typically varies over a 24-hour period), in combination with boluses of the same insulin at meals and drinks containing carbohydrates. Both basal and bolus insulin are delivered by the insulin pump, which infuses insulin a fine bore subcutaneous cannula.

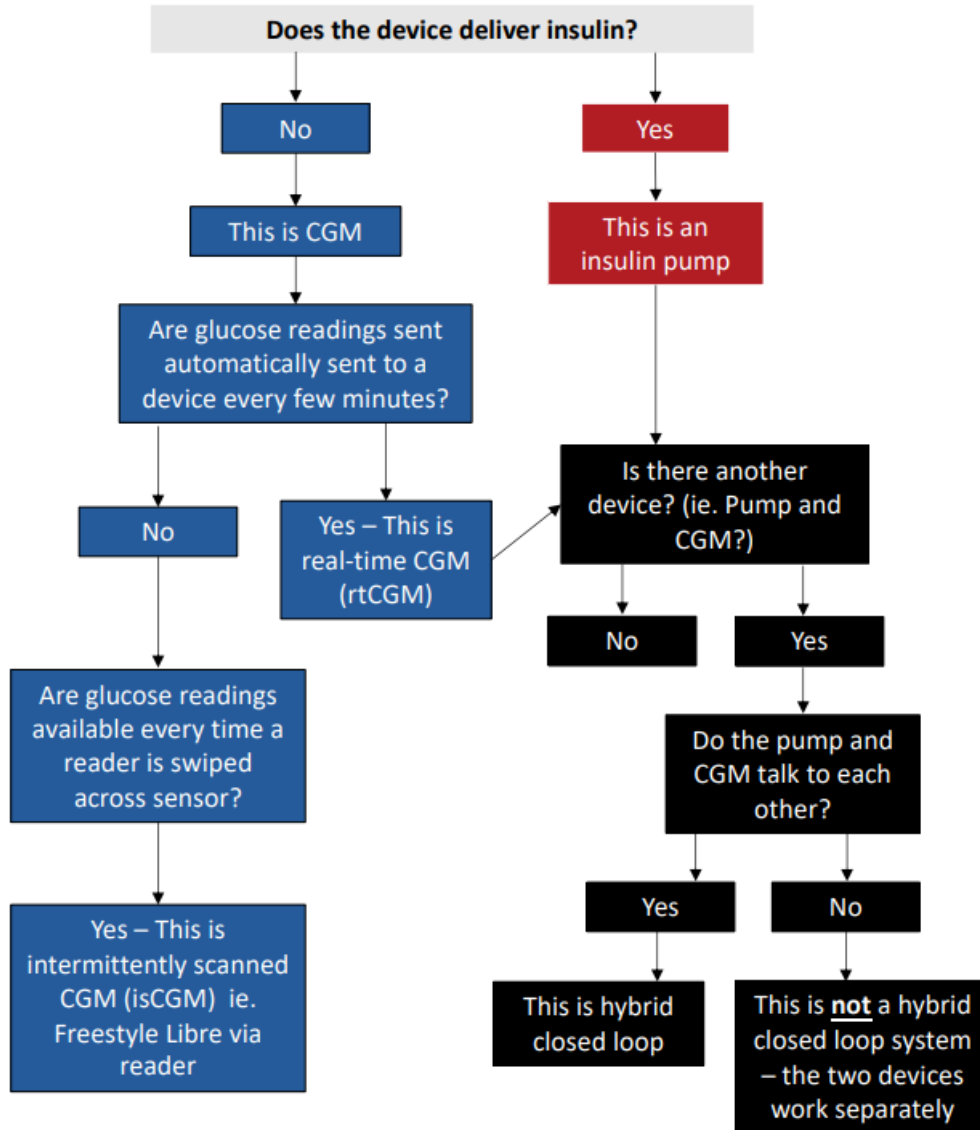
There are limited data and guidance on real-world use and safety of hybrid closed loop systems in the hospital setting. In someone who is well, and may be in hospital for a short elective procedure or investigation, it may be appropriate to let the hybrid closed loop continue to control their glucose.

In someone who is unwell, insulin requirements can change rapidly from day to day and we recommend closed loop algorithms are “disengaged” and systems are switched to “manual” mode in the hospital setting. This allows the individual with support from their diabetes team to adjust insulin pump settings, including glucose target range, insulin sensitivity factor, and basal rates.

There are increasing case reports of using hybrid closed loop systems in surgery, but these should only be used with the anaesthetist working in close collaboration with the diabetes inpatient teams, with close monitoring and a clear plan and knowledge of using these systems.

Wearable devices in special circumstances: Do not use CGM and CSII in those acutely unwell or haemodynamically unstable patients. CGM and CSII should not be used during hyperglycaemic emergencies or in ITU setting. Revert to CBG checks. CSII should be replaced with VRIII or MDI injections. Radiological investigations: For MRI all CGM devices should be removed (except the implantable Eversense sensor). Insulin pump should be temporarily suspended and removed. For CT, CGM and CSII can be either removed or covered with a lead shield. For X ray, no need to remove pump. For FDG-PET, not to bolus via pump <4 hours prior to procedure but basal insulin can be continued through pump.

Figure 1: Identifying which diabetes technology is being used



Note: Some pumps are wireless (i.e. patch pumps) and may look similar to a CGM device. Some pumps display CGM readings on the device (ie. if working as a hybrid closed loop system) and should not be mistaken for CGM.

Figure 2: Recommendations for use of CGM and Insulin pump during surgery/procedure

CGM	Insulin pump
During Elective Surgery and/or Procedures	
<ul style="list-style-type: none"> CGM may be used to guide capillary or blood gas glucose monitoring CGM Should not be used to base treatment decisions CGM sensor should be situated away from the operative site and the diathermy pad(s) Do not use in event of intra-operative hypotension or haemorrhage <p>Minor procedures (e.g. OGD/colonoscopy)</p> <ul style="list-style-type: none"> CGM can be continued 	<p>Major surgical procedures (>1 missed meal):</p> <ul style="list-style-type: none"> Stop insulin pump, remove and store in safe place Ensure alternative strategy for insulin delivery appropriate for major surgery (VRIII) <p>Minor procedures (no more than 1 missed meal with/ without sedation eg OGD/colonoscopy)</p> <ul style="list-style-type: none"> Can continue using insulin pump** Only a Teflon® cannula should be used (steel needles contraindicated due to hypothetical risk of diathermy conduction) During fasting, standard basal rates may be continued Insulin pump should be situated away from the operative site and the diathermy pad(s) Ensure VRIII prescription and basal insulin is prescribed in case of pump failure <p>Further guidance and checklists found in Appendix 7: Wearable technology during elective procedures and UK Centre for Perioperative Care guidelines: https://cpoc.org.uk/guidelines-resources-guidelines-resources/guideline-diabetes</p>
During pregnancy and labour	
<ul style="list-style-type: none"> Can be used safely during pregnancy and labour delivery Do not use to guide maternal VRIII Ensure sensor is moved to the arm prior to caesarean section, so does not interfere with the operative field 	<ul style="list-style-type: none"> Can be used safely during pregnancy and labour delivery If the mother-to-be (or partner) does not feel confident managing the insulin pump during labour, or if blood glucose not appropriately controlled, then VRIII should be started instead. Consider starting VRIII if two consecutive blood glucose levels are above the target range (7.0 as per NICE or 8.0 mmol/L as per JBDS-IP guidance) https://abcd.care/resource/jbds-09-use-variable-rate-intravenous-insulin-infusion-vriii-medical-inpatients After delivery, revert to pre-pregnancy basal infusion rates to minimise risk of hypoglycaemia
Pacemakers	
<ul style="list-style-type: none"> There is an absence of data on use of pacemakers with CGM and more needs to be known with regards to safety, accuracy and compatibility 	
Cardiac arrest	
<ul style="list-style-type: none"> CGM devices should ideally be removed for external DC cardioversion (but do NOT delay CPR) Do not use CGM glucose to guide treatment of hypoglycaemia in cardiac arrest 	<ul style="list-style-type: none"> Insulin pump should ideally be removed for external DC cardioversion (but do NOT delay CPR)

* Pumps can be safely suspended/removed for up to an hour at a time without needing alternative insulin. A correction bolus may be needed on reconnecting the pump.

**Prerequisites for safe perioperative use must be met.

The use of CSII lends itself to the safe management of the surgical patient with diabetes undergoing a short fasting period (i.e. no more than one missed meal). See Table 7- 8.

The purpose of this guideline is to facilitate the perioperative use of CSII in people with diabetes who meet agreed criteria and who wish to continue the use of their CSII having been fully informed of the risks and the alternatives through the process of SDM.

This guideline has been developed jointly by anaesthetists and diabetologists who share a wish to improve the perioperative care of people with diabetes undergoing surgical procedures.

Shared Decision Making and the use of CSII

SDM is an essential part of healthcare delivery, and the management of blood sugars during surgery is no different. The Academy of Medical Royal Colleges and Choosing Wisely UK recommend the following four questions should be used to make better decisions together:

1 what are the **B**enefits?

2 what are the **R**isks?

3 what are the **A**lternatives?

4 what if I do **N**othing? (with the acronym of **BRAN**) BRAN lends itself to the SDM process of perioperative glycaemic management for the person on a CSII.

Alternatives to CSII

- VRIII.
- MDI.
- Individually calculated dose of long-acting insulin analogue

Table 7: Requisites for safe perioperative use of CSII (all conditions must be met)

Requisites for safe perioperative use of subcutaneous insulin pumps (all conditions must be met)
• The person with diabetes should be seen preoperatively by a registered health care practitioner who is knowledgeable about the perioperative use of insulin pumps
• Documentation of discussions and decisions made with the person with diabetes
• Multidisciplinary agreement that continued use of insulin pumps is appropriate
• Provision of an information leaflet for people in hospital
• Ability to communicate with medical teams
• Short fasting period (for example no more than one missed meal)
• Elective or expedited surgery
• Optimal preoperative HbA1c <69mmol/mol where safe to achieve
• Ability to site pump away from the site of proposed surgery
• Ability to avoid positioning the insulin pump between the earthing plate and the diathermy
• Use of a Teflon® cannula (and not a steel cannula)
• Sufficient Teflon® consumables
• Ability to monitor CBG or via blood gas regularly (i.e. every 60 minutes) and to monitor capillary blood ketones
• Ability to replace subcutaneous insulin pump with variable rate intravenous insulin infusion (VRIII) if necessary

Table 8: Contraindications to insulin pump therapy in hospital

Contraindications to insulin pump therapy use in hospital
• Impaired level of consciousness or confusion
• Critical illness requiring intensive care/ high dependency care
• Diabetic ketoacidosis or hyperosmolar hyperglycaemic state
• During MRI
• Psychiatric illness or suicidal ideation
• The individual is unable to use hands and/or physically manipulate pump due to medical condition
• The individual is unwilling to participate in diabetes self-management, or share pump management decisions with hospital clinical staff
• Lack of pump supplies or mechanical pump malfunction
• Lack of trained healthcare providers or available diabetes specialists to supervise pump therapy
• Medical team decision for health and safety of the individual

Adapted from Umpierrez GE et al, Diabetes Care. 2018;41(8):1579-1589 and Yeh et al. Curr Diab Rep. 2021;21(2):7.

Other situations where there is limited safety data to allow continued use of insulin pumps:

- During major surgery
- As part of hybrid closed loop systems in hospital

Practicalities in preoperative clinic

- Gain consent and ensure a shared decision making process undertaken regards the perioperative use of CSII.

- Document decision along with the SDM discussion.
- Ask the person with diabetes to monitor their CBG hourly on the day of surgery and aim to keep their glucose levels between 6–10mmol/l from day of admission.
- If the person with diabetes usually wakes up in the mornings with a CBG<6mmol/l ask them to reduce the rate to 80% of normal rate at bedtime.
- If the person with diabetes usually gets CBG's less than 6mmol/l during the day, inform the person with diabetes to reduce basal to 80% of normal on awakening on the day of surgery.
- Inform the person with diabetes on where to site their cannula and pump on the day of admission/ on arrival in hospital.
- Inform the person with diabetes to use a Teflon® cannula set on the day of surgery.
- The Teflon® cannula needs to be observable and accessible during their time in theatre, and not near the operative field. The upper arm is generally a good place for abdominal and lower limb surgery, whilst the thigh is generally a good place for head, neck and upper limb surgery.
- The pump needs to be positioned so that it can be observed to ensure correct functioning and must not be in between the diathermy plate and the diathermy.
- Ask the person with diabetes to bring in sufficient consumables.

On admission

- Check CBG is in the range of 6–10mmol/l.
- Check correct siting of Teflon® cannula (upper arm for lower body surgery and thigh for upper body). The person with diabetes can move it to the desired place once in hospital.
- Check that cannula is Teflon®.
- Ensure the anaesthetist is happy for the perioperative use of CSII and is happy with the position of the Teflon® cannula.
- The person with diabetes to demonstrate the following to the clinical team
 - How to assess correct functioning of the pump.
 - How to safely detach the cannula if needed.
 - If these criteria cannot be met, consider VRIII.

In theatre

- Check CBG every 30–60 minutes and that it is in target range 6–10mmol/l (6–12mmol/l is acceptable).
- Position pump away from **diathermy**, and is not between diathermy and earthing plate, and ensure that it and the cannula site is visible and accessible.
- Check correct connection and functioning of pump (**DKA** will occur swiftly if it is disconnected).
- If these criteria cannot be met, a VRIII should be started.
- Check and record CBG every 30–60 mins.
- If the glucose rises above 12mmol/l consider pump failure as a cause (NB the pump will not necessarily alarm in this instance), check ketones, start VRIII and remove pump cannula.
- Store the pump carefully, ensuring it is labelled with the person with diabetes' details. Give the pump to the recovery staff to give back to the person with diabetes.

In recovery

- Check CBG is in target range 6–10mmol/l (6–12mmol/l is acceptable).
- Check correct connection and functioning of pump (DKA will occur swiftly if disconnection occurs).
- If these criteria cannot be met, consider a VRIII.
- Check and record CBG every 60 minutes.
- Aim to get person with diabetes eating and drinking once able to safely self-manage the insulin pump.
- Make sure that when the person with diabetes is going back to the ward the pump goes with them, if it has been disconnected at any time.

On the ward

- Check CBG is in target range 6–10mmol/l (6–12mmol/l is acceptable).
- Check the person with diabetes is satisfied with pump function and glucose management
- Move cannula to desired location (assist the person with diabetes to do this if needed).
- Inform the person with diabetes to check CBG more regularly for next two to three days

13. Summary of recommendations and patient information for non-operative procedures (Endoscopy /Colonoscopy/ PET scans)

1. Upper GI endoscopy / Bronchoscopy

See table 1-5 for monitoring and adjustments to oral and injectable medication

2. Colonoscopy (procedure requiring bowel preparation)

2.1 Day before procedure / day of bowel preparation Insulin treated patients

- a) Follow the advice provided about low residue food.
- b) Take the bowel preparation as instructed.
- c) Take additional clear fluid, and sugary drinks such as Lucozade® or clear fruit juice to maintain the blood glucose levels.
- d) Test your blood glucose levels before administering insulin.

NOTE: For ECT, please refer to standalone document 'Diabetes care for patients undergoing ECT treatment'.

- e) Take half the usual dose of short acting (Novorapid®/Humalog®/Apidra®/Actrapid®/Humulin S®) or mixed insulin (Novomix 30®/Humulin M3®/Humalog Mix 25®).
- f) Take the usual dose of long-acting insulin (Lantus®, Abasaglar®, Toujeo®, Tresiba®, Semglee®,Levemir®).

Non-insulin treated patients

- a) Omit any diabetes tablets

2.2 Day of procedure: insulin treated or non-insulin treated patients

Follow the guidance (Table 1-5) for the day of surgery

Non-operative procedures (Endoscopy/Colonoscopy/PET scan)

Patient information for people with Diabetes:

Monitoring: Due to you fasting for a long period of time, if you are on insulin or glucose lowering medications, you are more prone to have a low blood sugars/ glucose levels. It is important to check you glucose levels more often over this period of time (2 hourly if worried).

Hypoglycaemia (low sugar /glucose levels): Hypoglycaemia also known as a “hypo” is when your blood sugar (glucose) levels fall too low. Any blood glucose below 4.0 mmol/l should be treated.

Symptoms of hypoglycaemia: Blurred vision, excessive sweating, anxiety or aggression, tingling in mouth or fingers, fast or heavy heartbeat, odd behaviour (usually noticed by another person) sudden difficulty with concentration and blurred vision

What to do if you have a hypo while fasting: If you find your levels are under 4mmols you must break your fast with 250mls of a non-diet fizzy drink. Ensure your blood glucose levels have improved. Once recovered from hypo, you need to check your glucose levels every hour until you have had your procedure. If you notice your levels have dropped again below 4 mmols during your hourly checks you can take another 250mls of non-diet fizzy drink. Please when you arrive at the Endoscopy unit inform the staff that this occurred prior to you coming into hospital so they can monitor you more closely.

14. Education and Training

We recommend that all healthcare professionals who prescribe, handle, prepare or administer insulin undertake all either face-to-face training on the safe use of insulin or undertake the relevant e-learning module available via HELM.

All clinical staff working in any location within UHL would be expected to seek senior advice or advice from the diabetes team if they were unsure of how to manage a patient with diabetes.

15. Monitoring and Audit Criteria

Monitoring of adherence to the guidance will be monitored by the Peri-operative Diabetes Group and the Diabetes Inpatient Safety Committee. Reporting of NaDIA-Harms and participation in the annual NaDia audit will provide benchmarked data

Below are examples of local audit standards recommended by the Joint British Diabetes Societies.

Indicator	Standards
Access:	
Percentage of staff involved in the care of people with diabetes undergoing surgery or procedures who have received training in blood glucose measurement.	100%
Percentage of staff involved in the care of people with diabetes undergoing surgery or procedures receiving appropriate education from the Diabetes Inpatient Specialist Team.	80%
Safety, Quality, and Effectiveness During the Patient Journey:	
Percentage of primary care referrals containing all suggested information (appendix 12).	100%. Where necessary, education programmes should be instituted to engage with primary care colleagues to raise the standard of referral letters.
Percentage of patients with poorly controlled diabetes referred for pre-operative optimisation of diabetes control prior to attending pre-assessment clinic.	100%
Percentage of patients for whom a perioperative diabetes management plan is created at the pre-operative assessment clinic.	100%
Percentage of people with diabetes who are listed for elective surgery who are admitted on the day of the procedure.	90%. An exclusion for this is where other significant co-morbidity needs pre-operative optimisation.
Percentage of people with diabetes that are listed on the first third of the operating list (morning or afternoon lists).	95%
Percentage of people in whom a VRIII is established with correct configuration of the one-way and anti-siphon valves.	100%
Length of stay for patients with diabetes undergoing surgery or procedures.	No longer than 10% greater than for people without diabetes.
Percentage of people with diabetes and a condition not usually requiring a post-operative overnight stay that are operated on electively during an evening list.	0%
Percentage of patients with diabetes who receive hourly monitoring of blood glucose during their procedure, and in recovery.	100%
Percentage of time that people with diabetes have their blood glucose levels kept between 6 to 10 mmol/L (although 4 to 12 is acceptable) during their admission.	100%
Percentage of patients with evidence of poor peri-operative glycaemic control: <ul style="list-style-type: none"> - Diabetic ketoacidosis or Hyperosmolar hyperglycaemic state or Hypoglycaemia requiring 3rd party assistance 	0%
Percentage of patients where their discharge is delayed because of diabetes related problems.	0%
Institutional Accountability and Integrity:	
Percentage of patients with diabetes identified as such on hospital patient administration system.	95%
Percentage of clinical coding that identifies people with diabetes correctly.	100%
Patient and Staff Satisfaction:	
Percentage of staff who feel that they have sufficient levels of appropriate and timely support from the Diabetes Inpatient Specialist Team.	100%
Percentage of patients who express satisfaction with their patient journey, using validated tools such as the Diabetes Treatment Satisfaction Questionnaire (DTSQ) and the Diabetes Treatment Satisfaction Questionnaire for Inpatients (DTSQ-IP).	80%

16. Roles and Responsibilities:

Roles and responsibilities of clinical lead for perioperative diabetes care in hospitals

Each hospital should appoint a clinical lead for perioperative diabetes care. The clinical lead should:

- establish and lead a multidisciplinary team including at minimum: a patient representative, diabetes specialist, anaesthetist, surgeon, geriatrician, nurse, pharmacist, allied health professional, preoperative assessment team member, community representation (general practitioner, community diabetes team member) and manager from perioperative services
- work with the MDT to develop and disseminate local policies and procedures for perioperative management of people with diabetes to include those listed below
- establish a local quality improvement programme based on these recommendations, linking with listing datasets (NADIA, PQIP) and report the outcomes regularly to the board.

The clinical lead should ensure the following policies, procedures and guidelines (supported through training resources) are available and accessible to, and implemented by, all healthcare professionals involved in the care of people with diabetes undergoing surgery:

- a policy outlining day surgery in people with diabetes (noting diabetes is not a reason to deny ambulatory surgery)
- a policy promoting admission on day of surgery in people with diabetes (noting diabetes specific pre-admission should be avoided)
- establishment of ER Programmes in people with diabetes (noting same principles for people with diabetes as those without diabetes)
- indications for involvement of the diabetes multidisciplinary team, including diabetes specialist nurse
- identification of high-risk people with diabetes, including those with Type 1 diabetes and emergency admissions, to ensure individualised care plans are proactively instituted
- a guideline on perioperative management of diabetes medication
- a guideline on indications for and use of variable rate intravenous insulin infusion
- a guideline on perioperative management of patients on continuous subcutaneous insulin infusions/ pump therapy and/or with continuous and flash glucose monitoring devices
- a policy to support reduction of the risk of medication errors (including timely medicine reconciliation)

- a policy describing strategies to reduce the risk of and harm related to hospital acquired hypoglycaemia and hospital acquired diabetic keto-acidosis (DKA)
- a strategy to avoid late cancellation of surgery and to ensure a root cause analysis of late cancellations in people with diabetes
- a policy to support safe and effective discharge from hospital, communicating with community services. The clinical lead and MDT should ensure consistent availability of monitoring equipment and appropriate medications. Guideline for Perioperative Care for People with Diabetes Mellitus Undergoing Elective and Emergency Surgery | 36
- All areas including every theatre to have immediate access to glucose meters
- All clinical areas to have access to ketone meters
- All places in the hospital where people with diabetes are managed should have access to treatment for hypoglycaemia, looming hypoglycaemia and hyperglycaemia. This includes access to insulin syringes and vials of rapid acting insulin analogue preparation and 20% glucose.

The clinical lead and MDT should work with people with diabetes to:

- co-design, co-develop and disseminate patient information leaflets to include:
 - what people with diabetes can expect during surgery in relation to diabetes management
 - what medication changes and target levels are necessary preoperatively
 - importance of and practical advice on preoperative and postoperative lifestyle modification
 - promotion of patient self-management of diabetes during admission with signposting to supportive services (see JBDS. Self management of diabetes in hospital)

17. Supporting Documents and Key References

1. Guideline for Perioperative Care for People with Diabetes Mellitus Undergoing Elective and Emergency Surgery <https://cpoc.org.uk/sites/cpoc/files/documents/2022-12/CPOC-Diabetes-Guideline-Updated2022.pdf>Hypo
2. Guidelines for the Management of Diabetic Ketoacidosis (DKA) in Adults [http://insitetogether.xuhl-tr.nhs.uk/pag/pagdocuments/Diabetic%20Ketoacidosis%20\(DKA\)%20in%20Adults%20UHL%20Guideline.pdf](http://insitetogether.xuhl-tr.nhs.uk/pag/pagdocuments/Diabetic%20Ketoacidosis%20(DKA)%20in%20Adults%20UHL%20Guideline.pdf)

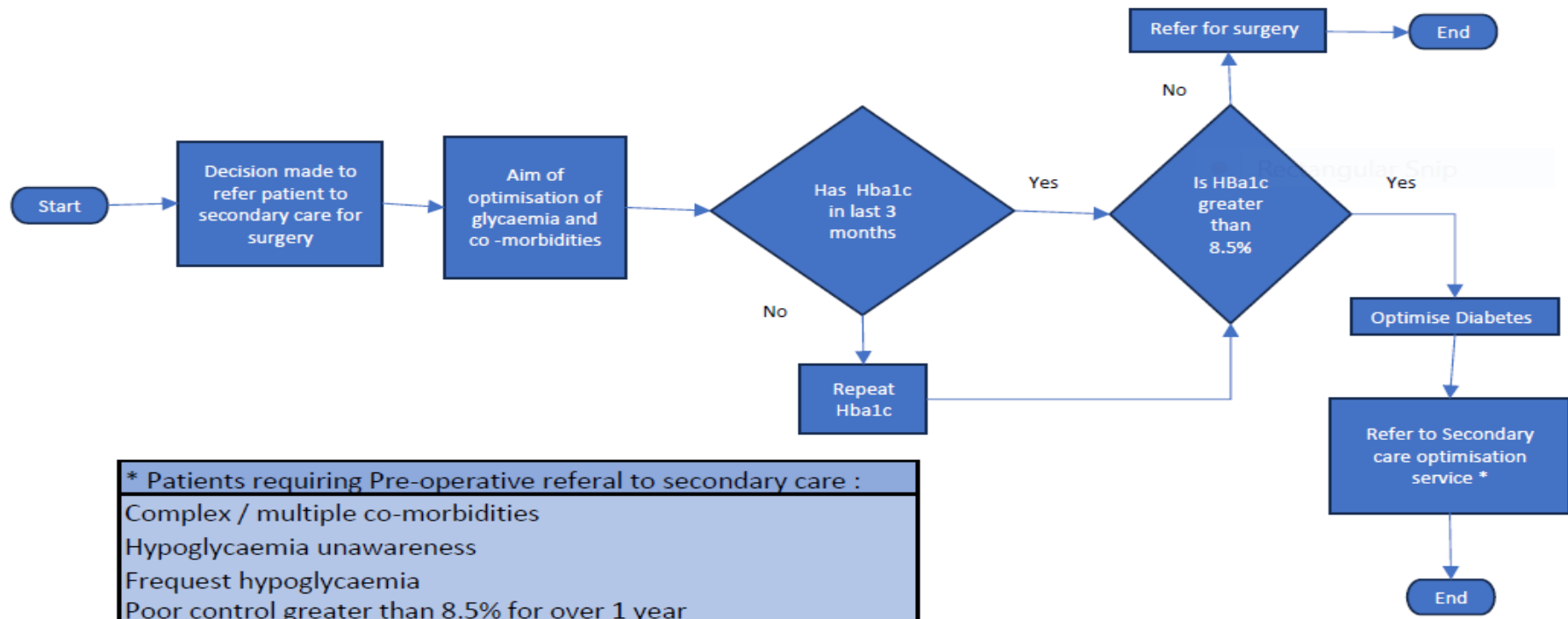
3. Guideline for the Management of Hyperosmolar Hyperglycaemic State (HHS) in Adults (previously known as Hyperosmolar Non-Ketotic Diabetic state (HONK))
[http://insitetogether.xuhl-tr.nhs.uk/pag/pagdocuments/Hyperosmolar%20Hyperglycaemic%20State%20\(HHS\)%20in%20Adults%20UHL%20Guideline.pdf](http://insitetogether.xuhl-tr.nhs.uk/pag/pagdocuments/Hyperosmolar%20Hyperglycaemic%20State%20(HHS)%20in%20Adults%20UHL%20Guideline.pdf)
4. Hyperglycaemia in Adult Inpatients with Diabetes – including Decision Support Tool UHL Guideline <http://insitetogether.xuhl-tr.nhs.uk/pag/pagdocuments/Hyperglycaemia%20in%20Adult%20Inpatients%20with%20Diabetes%20-%20including%20Decision%20Support%20Tool%20UHL%20Guideline.pdf>
5. Variable Rate Intravenous Insulin Infusion (VRIII) For Adult Inpatients With Diabetes UHL
6. Treat hypoglycaemia according to UHL guidance: Trust Reference B41/2011 Hypoglycaemia in Adults with Diabetes UHL Guideline (2)
<http://insitetogether.xuhl-tr.nhs.uk/pag/pagdocuments/Hypoglycaemia%20in%20Adults%20with%20Diabetes%20UHL%20Guideline.pdf>
7. with%20Diabetes%20UHL%20Guideline.pdf
8. NOTE: this guidance (management of hypoglycaemia) is at slight variance with the standard management of hypoglycaemia. This is to provide individualized care during the highly monitored peri-operative period.
9. Manage post-op hyperglycaemia according to the UHL Hyperglycaemia Decision support tool Trust Reference B27/2019 (5)
<http://insitetogether.xuhl-tr.nhs.uk/pag/pagdocuments/Hyperglycaemia%20in%20Adult%20Inpatients%20with%20Diabetes%20-%20including%20Decision%20Support%20Tool%20UHL%20Guideline>. NOTE: this guidance (management of hyperglycaemia) is at slight variance with the standard management of hypoglycaemia. This is to provide individualized care during the highly monitored peri-operative period
10. Novel Approach to Continuation of Elective Procedures in People at Risk for Sodium–Glucose Cotransporter 2 Inhibitor–Associated Euglycemic Ketoacidosis. Matthew Verdone; Jonathan Bauman; Esben Iversen ORCID logo ; Rifka Schulman-Rosenbaum ORCID logo ; Anthony Antonacci ORCID logo ; Sabatino Lefte; Joseph Simpson; Yael Tobi Harris; Joseph Marino
11. Using technology to support diabetes care in hospital: A guideline from the Joint British Diabetes Societies for Inpatient Care (JBDS-IP) Group and Diabetes Technology Network (DTN) Revised March 2024
https://abcd.care/sites/default/files/resources/JBDS_20_Using_Technology_to_Support_Diabetes_Care_in_Hospital_1.pdf

DEVELOPMENT AND APPROVAL RECORD FOR THIS DOCUMENT

Lead/ Author/s	Dr Sowmya Setty Dr Amy Bhatia Mrs Danielle Bruce Dr Elaine Hart Ms Fiona Adlam	Diabetes Consultant SpR Anaesthesia Peri-operative DSN Consultant Anaesthetist Pharmacist with SI Diabetes
Reviewed by	Diabetes Inpatient Safety Committee, ITAPS Q&S Board	
Approved by:	Policy and Guideline Committee	Date Approved:

APPENDIX: Flowcharts

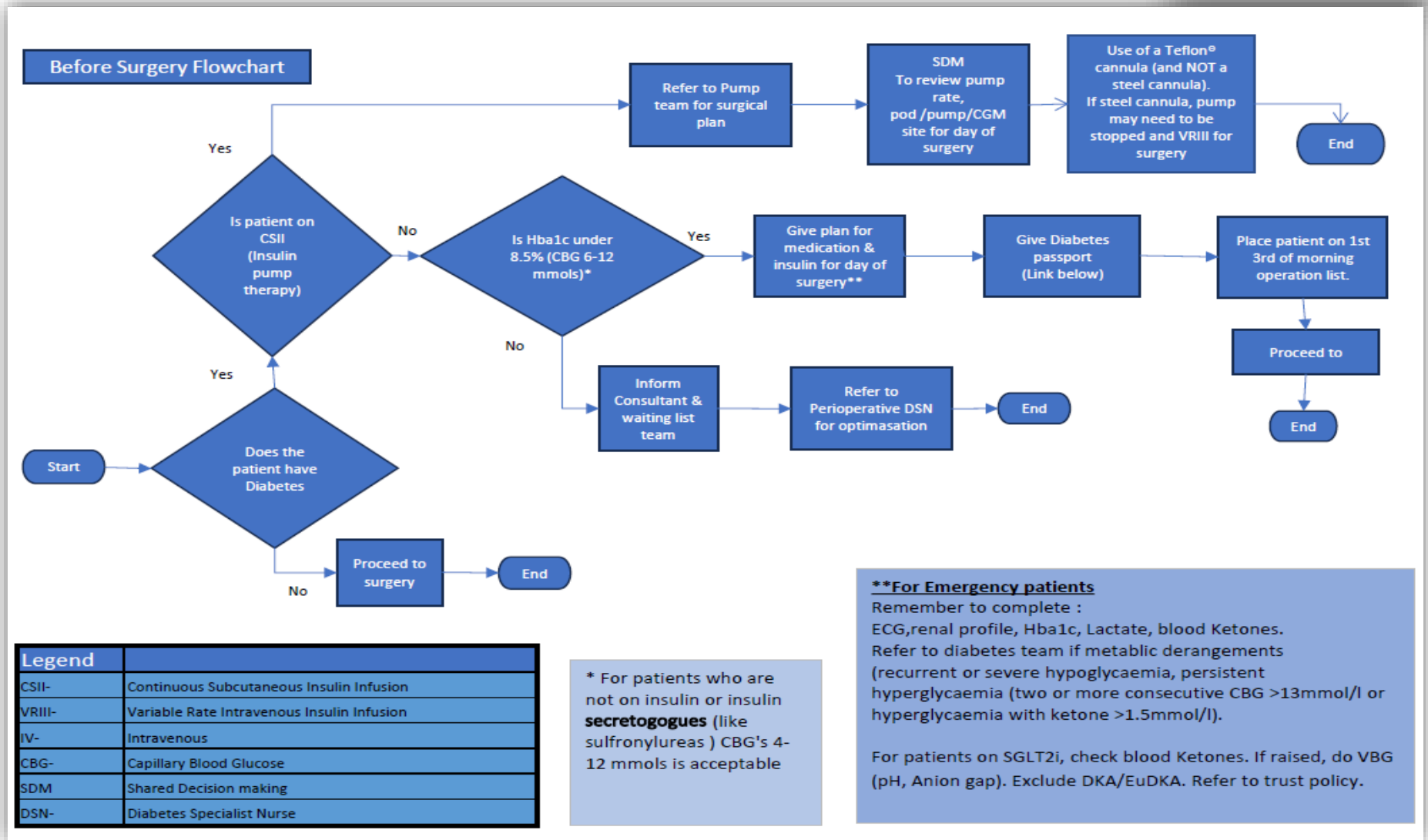
Primary Care Pathway



*** Patients requiring Pre-operative referral to secondary care :**
 Complex / multiple co-morbidities
 Hypoglycaemia unawareness
 Frequent hypoglycaemia
 Poor control greater than 8.5% for over 1 year
 Patients on insulin Pump therapy /CSII
 Patient already under Secondary care

Primary care referrals requesting surgical consultations for people with diabetes should include a comprehensive patient summary and should aim for optimisation of glycaemic control, diabetes related co-morbidities and any other comorbidities impacting on general health and wellbeing

APPENDIX: Flowcharts



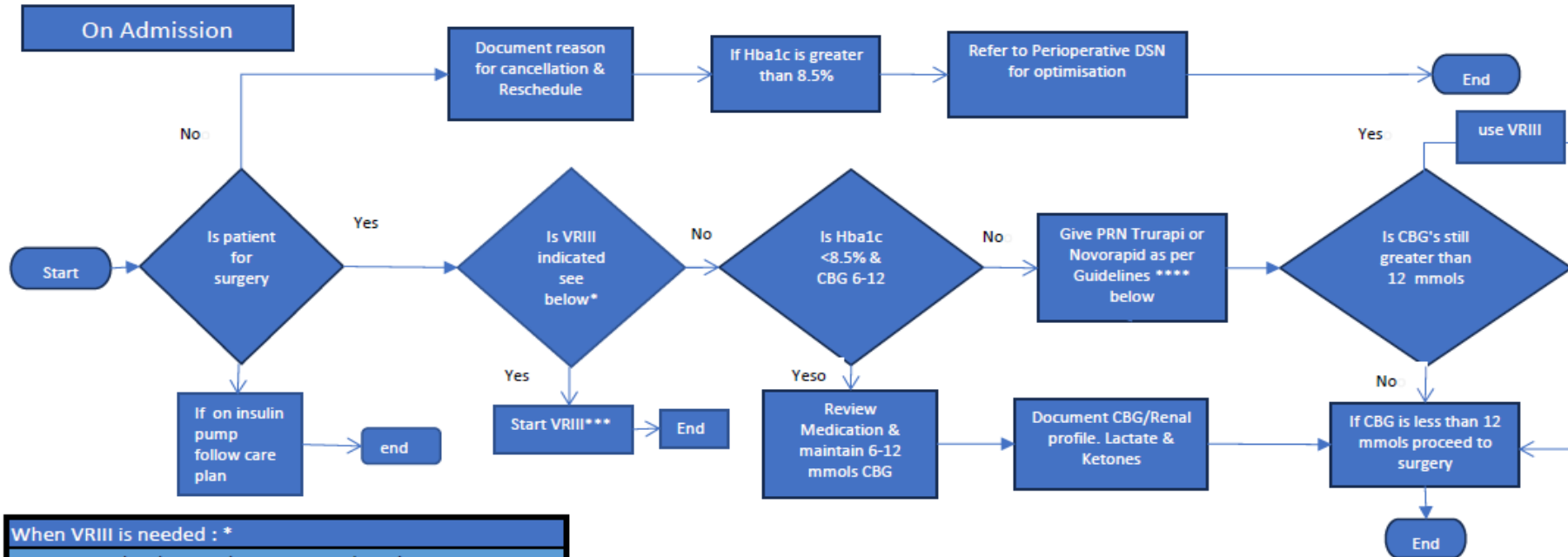
Legend	
CSII-	Continuous Subcutaneous Insulin Infusion
VRILL-	Variable Rate Intravenous Insulin Infusion
IV-	Intravenous
CBG-	Capillary Blood Glucose
SDM	Shared Decision making
DSN-	Diabetes Specialist Nurse

* For patients who are not on insulin or insulin **secretagogues** (like sulfonylureas) CBG's 4-12 mmols is acceptable

****For Emergency patients**
Remember to complete :
ECG,renal profile, Hba1c, Lactate, blood Ketones.
Refer to diabetes team if metabolic derangements (recurrent or severe hypoglycaemia, persistent hyperglycaemia (two or more consecutive CBG >13mmol/l or hyperglycaemia with ketone >1.5mmol/l).

For patients on SGLT2i, check blood Ketones. If raised, do VBG (pH, Anion gap). Exclude DKA/EuDKA. Refer to trust policy.

APPENDIX: Flowcharts



When VRIII is needed : *
Fasting period with more than one missed meal
Most people with diabetes needing emergency surgery. Refer policy.
Hba1c is greater than 8.5%
Type 1 Diabetics who has not had long acting insulin
Persistent hyperglycaemia (>CBG 12 mmol/l / Ketones > 1.5 mmol/l)

** For patients who are not on insulin or insulin secretagogues (like sulfonylureas) CBG's 4-12 mmols is acceptable

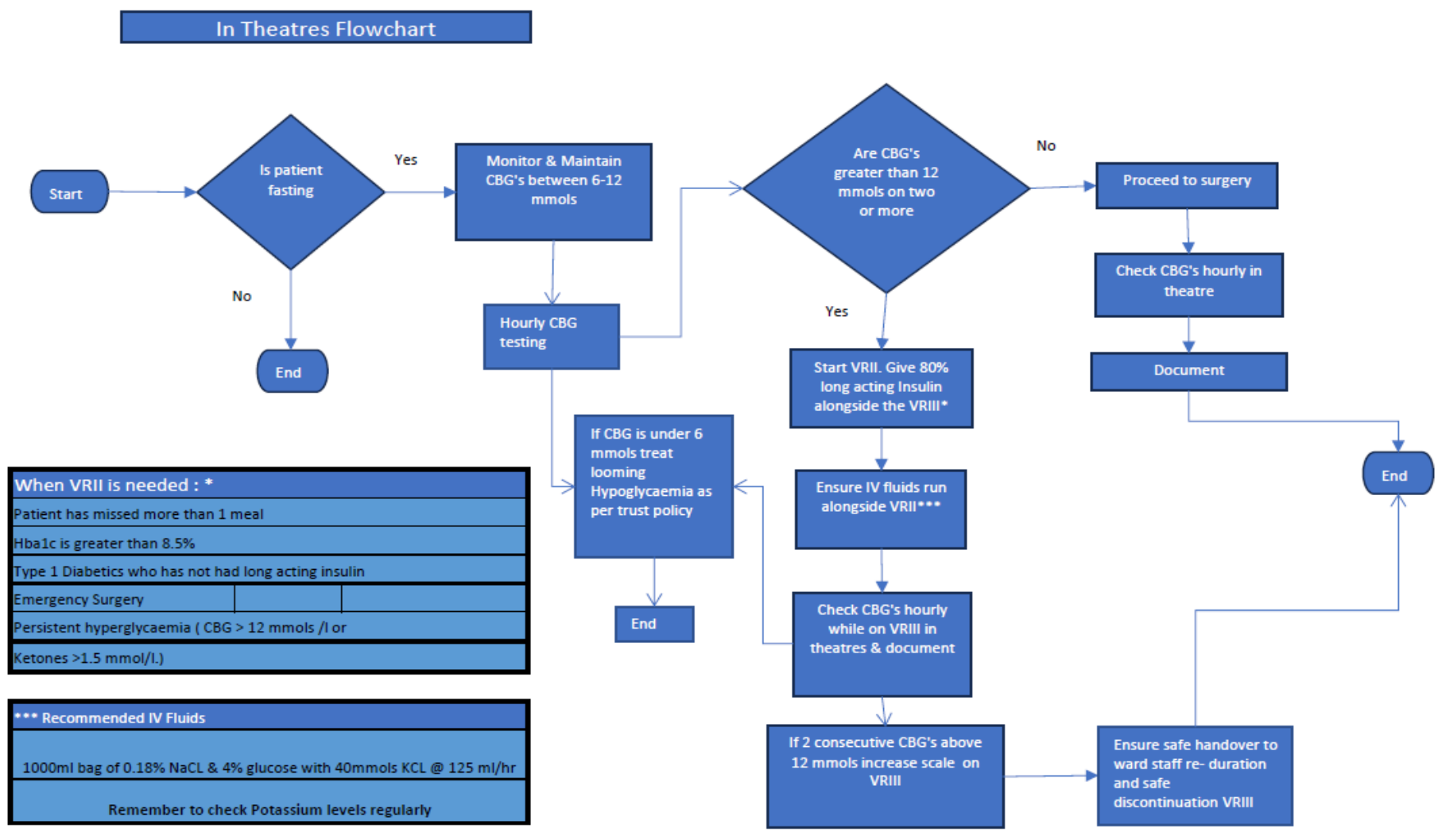
Legend	
CBG	Capillary Blood Glucose
DSN	Diabetes Specialist Nurse
PRN	As Required

*** Recommended IV Fluids
1000ml bag of 0.18% NaCl & 4% glucose with 40mmol KCL at 125ml/hr
Monitor Potassium , See VRIII policy check daily U&Es

****	Type 1 Diabetes	Type 2 Diabetes
CBG Result 14.1 - 17.9 mmols	Trurapi or Novorapid PRN doses 1 units of insulin reduces CBG by 3 mmols	Trurapi or Novorapid PRN Dose 3-4 Units
Recheck CBG's in 60 minutes after PRN dose to ensure it is falling. Repeat dose after 2 hours if CBG > 12 mmols		

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