NHS Greater Glasgow and Clyde

CLINICAL GUIDELINE

Diabetes, Perioperative guideline for the management of Diabetes

A guideline is intended to assist healthcare professionals in the choice of disease-specific treatments.

Clinical judgement should be exercised on the applicability of any guideline, influenced by individual patient characteristics. Clinicians should be mindful of the potential for harmful polypharmacy and increased susceptibility to adverse drug reactions in patients with multiple morbidities or frailty.

If, after discussion with the patient or carer, there are good reasons for not following a guideline, it is good practice to record these and communicate them to others involved in the care of the patient.

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Important Note:

The online version of this document is the only version that is maintained.
Any printed copies should therefore be viewed as 'Uncontrolled' and as such, may not necessarily contain the latest updates and amendments.

Perioperative Guidelines for the Management of Diabetes

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Perioperative Guidelines for the Management of Diabetes 2026

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1. Introduction

This guideline aims to provide guidance to healthcare staff involved in the care of adult patients with diabetes undergoing elective and emergency surgery in the perioperative period. For the purposes of this document, the perioperative period is defined as when patients come into hospital for surgery or begin fasting (either on the day of surgery or the night before) until they are discharged from surgical care. However, as the patient moves beyond the immediate post-operative period (e.g. 24-48 hours) general in-patient pathways may be more appropriate. Clinical judgement should be used in these situations.

This guideline does **not** cover obstetric or paediatric patients.

Patients with diabetes require additional considerations when preparing for surgical interventions as a consequence of fasting, as well as the risk of metabolic decompensation with increased physiological stress. Preoperative planning with clear and well communicated plans for the perioperative period are essential for safe management.

Additional care should be taken for patients with diabetes who are at higher risk. These include but are not limited to patients who are insulin deficient (Type 1 or Pancreatic diabetes), patients with impaired hypoglycaemia awareness, patients who are fed via NG/ NJ or TPN, elderly patients, those with a history of chronic alcohol excess and patients with multi-morbidity. Clinicians should be alert to the possibility that lower BMI may in some circumstances be a sign of insulin deficiency and consequent greater risk of metabolic decompensation.

2. Pre-operative assessment

In elective cases, all efforts should be made to optimise glycaemic control prior to surgery as poor control is linked to adverse outcomes. Patients with $HbA1_C$ > 69mmol/mol (checked within 3 months of date of surgery) should be highlighted to the team responsible for managing their diabetes via a SCI gateway referral and advice sought about any strategies for improvement.

In some circumstances, an $HbA1_c$ < 69mmol/mol is not necessary or desirable and individual decisions will be made based on an assessment of risk versus benefit by the surgical and anaesthetic team, with input from the diabetes team if required.

In more emergent cases, a risk assessment must be made regarding the benefits of delay to optimise diabetes management versus the need for surgical intervention.

Please ensure the surgical and anaesthetic team are informed of any concerns regarding diabetes management or control.

In all cases, clear plans for withholding oral medication, reduction or withholding insulin and need for additional management strategies e.g. VRIII, as well as restarting usual medications post operatively must be clearly documented and visible for all staff involved in the patients care (see Section 4 for further guidance). SCI-Diabetes pre-

operative assessment form should be used to document this in the case of elective surgery and this **must** be reviewed by medical and nursing staff pre and post operatively. In unplanned/ emergency surgery, this is the responsibility of the admitting surgical team with input from the anaesthetist if required and **must** be clearly communicated to nursing staff.

3. Perioperative monitoring requirements, CBG targets and ketone measurements

Capillary blood glucose

Capillary Blood Glucose (CBG) targets are 6-10 mmol/l in the perioperative period (4-14 mmol/mol may be acceptable but clinical judgment should be used as to the appropriate target and this should be clearly documented). Factors that can influence this decision may include but are not limited, to clinical assessment of likely insulin reserve and risk of ketosis, physiological stress associated with intervention, co-morbidities and risk of hypoglycaemia.

Patients on a VRIII require hourly CBG monitoring initially, although this can be reduced if CBGs have been stable as per the VRIII guidelines.

People with diabetes should have **CBG checked at least four times daily** in the perioperative period and more frequently if unstable or out with optimal range. In addition, CBG checks should be undertaken:

- At start and end of procedure
- In recovery
- On arrival back to ward area

CBGs should be clearly documented in the NEWS chart or Insulin Prescription Administration Record (IPAR).

GGC Clinical Guidelines are available for the management of hypoglycaemia (Appendix 1) and hyperglycaemia (Appendix 2). CBGs between 4-6 mmol/l can be considered "looming hypoglycaemia". It may be appropriate to adjust insulin, treat with oral carbohydrate or parenteral glucose in these situations depending on the clinical context.

Capillary blood ketones

Capillary blood ketone (CBK) measurements are currently available in some but not all clinical areas in GGC. Urinary ketones are an appropriate substitute although consideration to the delay in the rise of urinary ketones must be considered. This lag time can be between 2-4 hours due to their reliance on renal filtration and bladder accumulation.

Capillary Blood Ketone result	***Interpretation***	***Action***
< 0.6 Negative urine ketones	Normal	Monitor if indicated (see below)
0.6 – 3.0 *Urine ketones ++ is equivalent to CBK 1.5-3.0	Additional insulin MAY be required Additional carbohydrate MAY be required Additional fluid MAY be required	Check venous blood gas (VBG) to assess hydrogen ion concentration (consider DKA) Monitor CBG & CBK 2 hourly until returns to normal In people normally managed with insulin, consider additional insulin bolus (5-10% total daily dose) If CBG <14mmol/mol it is crucial to ensure adequate carbohydrate is administered to prevent hypoglycaemia (eg 50g carbohydrate every 4-5 hours in form of 500ml fruit juice if able to E&D or 500mol 10% dextrose IV in people not managed with insulin, main focus is on adequate hydration and carbohydrate administration (as above)
> 3.0 **Urine ketones +++ or ++++	Significant risk of DKA even if normal blood sugar	Check venous blood gas (VBG) to assess hydrogen ion concentration (consider DKA) If acid base status is normal, monitor CBG & CBK 2 hourly until returns to normal In people normally managed with insulin, consider additional insulin bolus (10-20% total daily dose) If CBG <14mmol/mol it is crucial to ensure adequate carbohydrate is administered to prevent hypoglycaemia (eg 50g carbohydrate every 4-5 hours in form of 500ml fruit juice if able to E&D or 500mol 10% dextrose IV in people not managed with insulin, main focus is on adequate hydration and carbohydrate administration (as above)

*** Ketone measurements should be considered in any patient with diabetes who becomes acutely unwell irrespective of whether they were normal when checked previously.
Urinary or capillary ketones must be checked if CBG > 14mmol/l in patients with any form of diabetes in the perioperative period. Out with this period, please refer to: Diabetes, inpatient prescribing FAQs (897) | Right Decisions,

Patients on SGLT2-inhibitors

Serious, life-threatening, and fatal cases of diabetic ketoacidosis (DKA) have been reported in people with diabetes taking an SGLT-2 inhibitor, with only modestly elevated blood sugars (often <14mmol/L). Risk factors for DKA in people with diabetes taking an SGLT-2 inhibitor

include conditions leading to a restricted food/fluid intake, such as those fasting for a procedure, taking bowel preparation for surgery or where an acute illness has reduced their oral intake.

Patients prescribed SGLT2 inhibitors should have these suspended as detailed in Section 4 of this guideline for scheduled procedures. If an SGLT2 inhibitor has not been suspended as detailed below, a risk assessment should be made of whether to continue with the planned procedure and ketone monitoring as detailed below should be followed.

Patients who are prescribed SGLT2 inhibitors who are admitted to hospital on an unscheduled basis, should have their SGLT2 inhibitor prescribed but suspended on admission. Reinstatement of treatment should be reviewed by a senior clinician within 24 hours of admission with knowledge of the patient's clinical condition and ketone measurements.

All patients admitted on an unscheduled basis who are prescribed an SGLT2 inhibitor must have a ketone measurement completed on admission. Ideally this is a capillary blood ketone measurement, however urine ketone measurement may be an appropriate alternative (bearing in mind the lag time)

Daily review of SGLT2 inhibitor prescription should be incorporated into daily ward round reviews.

For patients who were admitted on an unscheduled basis who had their SGLT2 inhibitor suspended, they should have daily ketone during the perioperative period and while SGLT2 inhibitor is withheld, even if CBGs are not elevated. Ketone measurements should be increased as detailed above if a patient becomes unwell while in hospital. If SGLT2 has been withheld for more than 7 days and ketones have not been elevated, it may not be necessary to continue daily ketone monitoring.

The decision to restart an SGLT2 inhibitor should be made by a senior decision maker provided the patient has returned to full dietary intake, ketones are normal, volume status is adequate and patient is well.

Any patient who developed DKA as a result of SGLT2 inhibitor use should have the decision to restart treatment discussed with the diabetic team before the medication is restarted.

4. Perioperative management of oral/ non-insulin sub cutaneous medications in fasting period

Medication	**Day before admission**	**Day of surgery**	
		Surgery in Morning	**Surgery in Afternoon**
***SGLT-2 inhibitor** (dapagliflozin, canagliflozin, empagliflozin)	Omit dose	Omit dose	Omit dose
** SGLT2 inhibitors should be withheld for at least 24hs post op and only restarted when patient is stable, well and eating and drinking normally.* ***For patient prescribed SGLT2 inhibitors CBK/ urine ketones should be checked once daily in the perioperative period or if unwell out-with this time even if SGLT2 inhibitor has been withheld or CBGs are not elevated.*** *If withheld for >7 days review the need for daily ketone checks as this may no longer be necessary if persistently normal. SGLT-2 inhibitors are also used for management of heart failure and renal impairment. The guidance re withholding SGLT-2 inhibitors should be followed, regardless of the indication for prescribing.*			
Metformin / Glucophage MR (procedure not requiring contrast media)	Take as normal	Omit morning dose	Omit all doses
Sulphonylurea (glibenclamide, gliclazide / gliclazide MR, glipizide, glimepiride)	Take as normal	Omit morning dose	Omit all doses
Thiazolidinedione (pioglitazone)	Take as normal	Take as normal	Take as normal
DPP-IV inhibitor (sitagliptin, vildagliptin, saxagliptin, alogliptin, linagliptin)	Take as normal	Take as normal	Take as normal
Acarbose	Take as normal	Omit morning dose	Take morning dose if eating breakfast. Omit lunchtime dose
Meglitinides (repaglinide, nateglinide)	Take as normal	Omit morning dose	Take morning dose if eating breakfast. Omit lunchtime dose
***GLP-1 analogue** (e.g. exenatide, liraglutide, semaglutide, dulaglutide, tirzepatide)	Take as normal	Take as normal	Take as normal
**GLP-1 analogues can affect gastric emptying and intestinal motility and there may be an increased risk of aspiration. A risk assessment involving the clinical team and patient should be undertaken in these patients regarding the risk of aspiration.*			

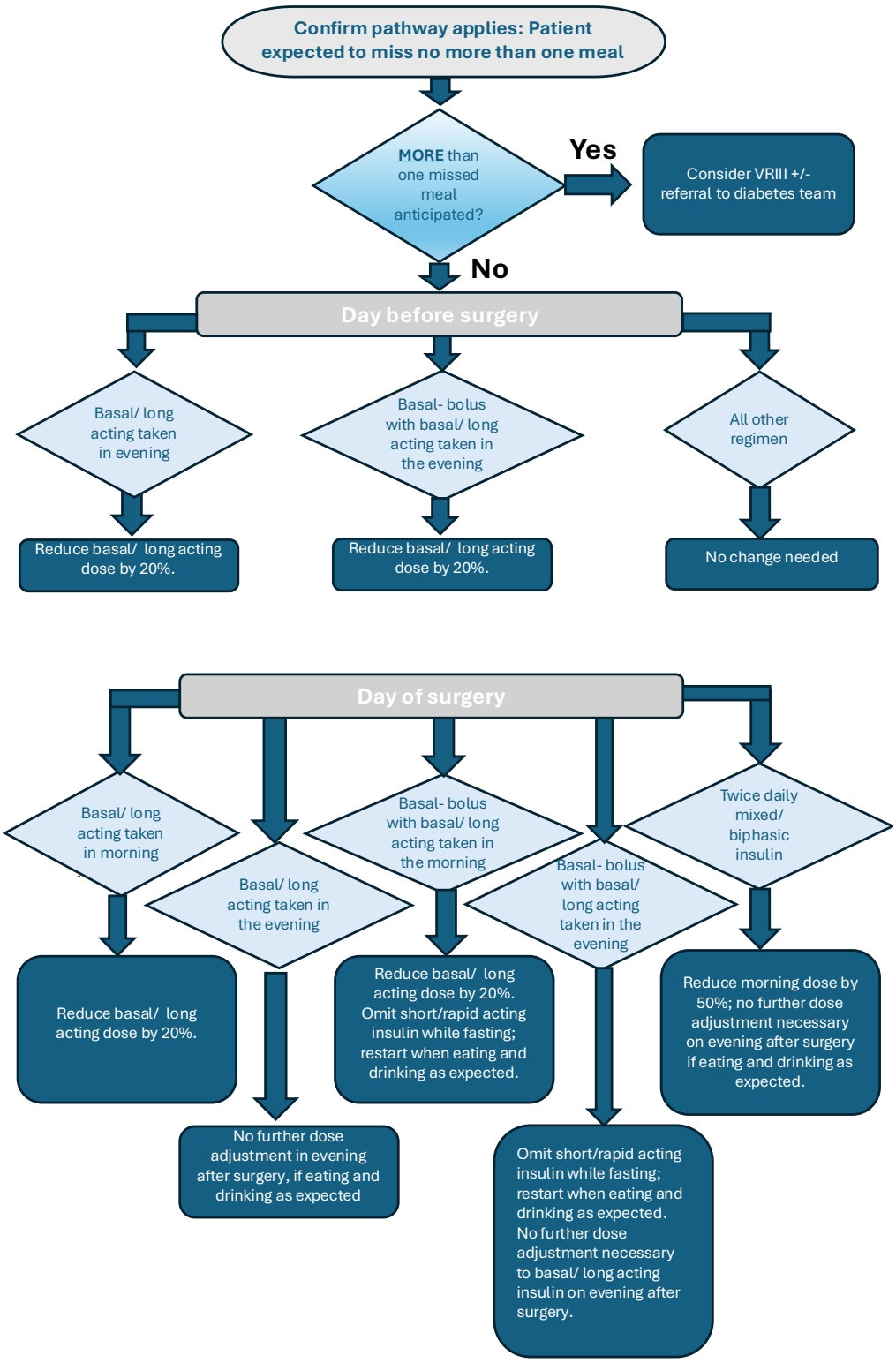
5. Perioperative management of subcutaneous insulin in patients Expected to miss **no more than one meal**.

The flow chart below can be used to advise on insulin adjustments for people treated with insulin who are expected to miss no more than one meal. Some additional points to consider:

Some people may be on less common regimens. Contact the diabetes team for advice in these circumstances.

Patients who are on enteral/ parenteral feeding should be discussed with the diabetes team to confirm a management plan.

Patients with HbA1C out with the range of 53-69mmol/l may be at risk of hypo or hyperglycaemia during the perioperative period. Consideration should be given to amending the above regime in these circumstances and early referral to parent diabetes team should be considered (see Appendix 3 for contact details of the relevant diabetes centres).


Confirm pathway applies: Patient expected to miss no more than one meal
MORE than one missed meal anticipated?
Yes
Consider VRIII +/- referral to diabetes team
No
Day before surgery
Basal/ long acting taken in evening
Basal- bolus with basal/ long acting taken in the evening
All other regimen
Reduce basal/ long acting dose by 20%.
Reduce basal/ long acting dose by 20%.
No change needed
Day of surgery
Basal/ long acting taken in morning
Basal/ long acting taken in the evening
Basal- bolus with basal/ long acting taken in the morning
Basal- bolus with basal/ long acting taken in the evening
Twice daily mixed/ biphasic insulin
Reduce basal/ long acting dose by 20%.
No further dose adjustment in evening after surgery, if eating and drinking as expected
Reduce basal/ long acting dose by 20%. Omit short/rapid acting insulin while fasting; restart when eating and drinking as expected.
Omit short/rapid acting insulin while fasting; restart when eating and drinking as expected. No further dose adjustment necessary to basal/ long acting insulin on evening after surgery.
Reduce morning dose by 50%; no further dose adjustment necessary on evening after surgery if eating and drinking as expected.

6. *Use of variable rate intravenous insulin infusion (VRIII)*

VRIII should be considered in the perioperative period in following circumstances:

- Elective or emergency surgery in patients treated with insulin who are anticipated to have a prolonged starvation period (i.e. more than one missed meal)
- Persistent hyperglycaemia following failed subcutaneous protocol (see hyperglycaemia protocol)
- People with poor glycaemic control (HbA1c >69mmol/l) particularly if surgical intervention is likely to induce significant physiological stress and recovery prolonged

In patients with poor glycaemic control (HbA1C > 69mmol/mol), the benefits of a VRIII should be balanced against the risks. In some circumstances where the surgical intervention is short, physiological stress is likely to be minimal and recovery predicted to be rapid, short term correction of hyperglycaemia/ accepting suboptimal control may be a pragmatic solution (see section 3 for further information).

The GGC VRIII guidelines can be found on the clinical guidelines platform:

Diabetes, Variable Rate Intravenous Insulin Infusion (671) | Right Decisions

Frequently asked questions are another useful resource and can also be found on the clinical guidelines platform:

Diabetes, variable rate Intravenous Insulin Infusion (VRIII) FAQs (923) | Right Decisions

Some key points regarding VRIII

- IV insulin should **always** be administered alongside carbohydrate containing fluid as substrate (e.g. 0.18% NaCl 4% glucose 0.15% KCl or 0.45% sodium chloride + 5% glucose + 0.15% potassium chloride)
- Basal/ long acting insulin (Tresiba, Levemir, Lantus, Humulin I etc.) should **continue** while a VRIII is running. Mixed/ biphasic insulin, combination of insulin and GLP-1 analogues (xultophy) and bolus/ short acting insulin should be **withheld** while a VRIII is running.
- The rate of IV insulin should be adjusted to maintain patients within target CBG range if the standard rate does not achieve this. This should be prescribed and documented on the front of the VRIII document.

7. *Use of continuous glucose monitors in the perioperative period*

Continuous glucose monitors (e.g. Freestyle Libre/ Dexcom) are worn for 10-14 days. These can remain in situ during surgical procedures if no contraindications e.g. location in surgical field. While some aspects of their functions may be useful (e.g. low glucose alarm) they should not be used for routine glucose monitoring during this period. They measure interstitial glucose thus have a "physiological time lag" of 10-15mins behind capillary glucose measurements and their accuracy is reduced at extremes of glycaemia. Therefore, capillary glucose measurements on a calibrated instrument are required.

8. *Use of continuous subcutaneous insulin infusion (CSIII) pump in the perioperative period*

Subcutaneous pumps and continuous glucose monitoring systems used separately or as part of a hybrid closed loop system are not recommended for use during surgical procedures by the manufactures of the devices, based on the perceived risk of damage to them by diathermy or imaging equipment. However, little/ no evidence exists currently to support this concern and there may be situations where use of continuous subcutaneous insulin pump would lead to better management of diabetes in the perioperative period. Use of CSIII presents a number of other potential hazards however and should only be undertaken by experienced staff in carefully selected patients according to approved local guidelines, pending GGC wide guidelines. Patients who use CSIII should be discussed with their diabetes team in the preoperative period to plan their diabetes management.
For patients who are admitted as an emergency, with CBGs out with target range, or evidence of ketotisis/ acidosis or unable to manage CSII independently, CSII should be disconnected and immediate administration of alternative insulin administered. This may be via VRIII or SC insulin. Patients on CSIII with an unplanned admission should be referred to the IP diabetes team via trak care at earliest opportunity.

9. *Post-operative care*

The perioperative care plan (which may be documented on SCI diabetes and/ or anaesthetic chart and or clinical notes) must be identified, checked and followed on return to a ward area.
CBGs should be checked on arrival and frequently thereafter (the frequency will depend on a number of factors e.g. eating and drinking, on VRIII etc.) but should be four times daily for most people with diabetes. If the required frequency is not clear, guidance should be sought from medical staff.
VRIII should never be stopped in a patient with diabetes treated with insulin or with a new diagnosis of T1/ pancreatic diabetes unless long acting/ basal insulin has been administered subcutaneously in the form of basal or mixed/ biphasic insulin.
Nausea and vomiting should be actively managed and normal eating and drinking should be promoted when it is safe to do so.

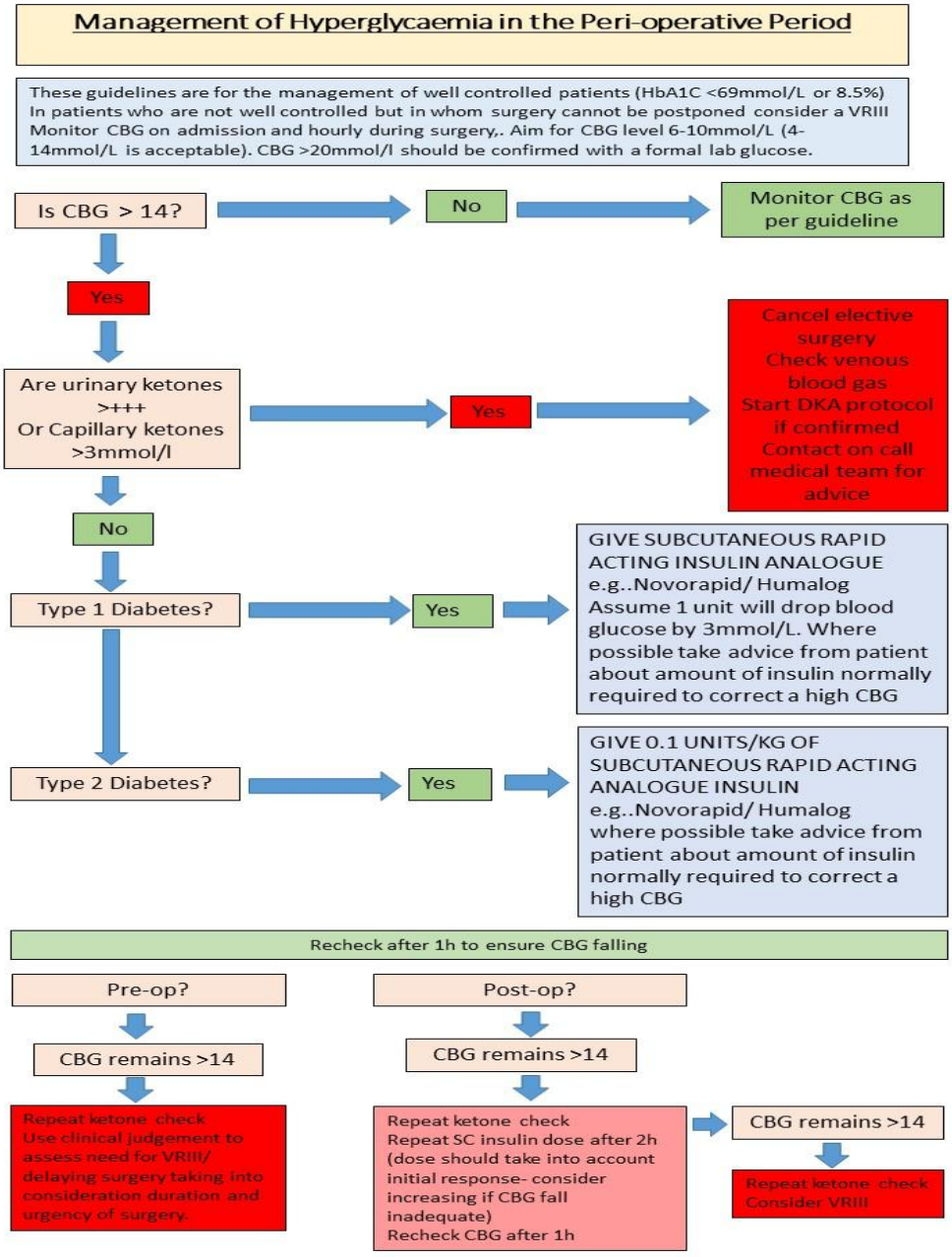
Oral medications and insulin should be restarted when patients are eating and drinking (with the exception of SGLT2 inhibitors- see section 4) however either or both may require dose adjustment if oral intake is substantially different from normal. This review and adjustment of diabetes related medication must be carried out by the team responsible for the patient during their inpatient admission. Any change to medication that persist on discharge must be clearly communicated to their GP on discharge letter along with plans for ongoing titration on recovery in the community. If required, advice can be sought via GGC guidelines relating to in-patient diabetes care or if required, referral to inpatient diabetes team (trak care) The management of hyperglycaemia in the immediate post-operative period should be managed according to the guideline in this document. Thereafter, information in the "Diabetes, Inpatient Prescribing FAQs for Junior Doctors" document on the GGC Clinical Guidelines platform or in the Therapeutics Handbook should be followed and additional advice from the inpatient diabetes team via a trak care referral sought if required.

Diabetes, inpatient prescribing FAQs (897) | Right Decisions

Appendix 1. Management of hypoglycaemia

Diabetes, Algorithm for Treatment of Hypoglycaemia in Adults with Diabetes (281) | Right Decisions

Appendix 2. Management of hyperglycaemia in the perioperative period



Appendix 3. Contact details for GGC diabetes teams

<u>Please note referrals for optimisation of HbA1c pre-operatively should be made via TrakCare as OP follow up will depend on patient postcode and diabetes subtype</u>

- **Gartnavel General Diabetes Centre**
  Phone no: 0141 211 3136
- **New Victoria/ South Hub Diabetes Centre**
  Phone no: 0141 3478279
- **Royal Alexandra/ Vale of Leven Diabetes Centre**
  Phone no: 0141 314 7009
- **Stobhill Diabetes Centre**
  Phone no: 0141 355 1076