Perioperative management of Insulin pump therapy

This guidance does not override the individual responsibility of health professionals to make appropriate decision according to the circumstances of the individual patient in consultation with the patient and /or carer. Health care professionals must be prepared to justify any deviation from this guidance.

Introduction

Continuous subcutaneous insulin infusion (CSII) or Insulin pump therapy has been increasingly used to manage patients with type I diabetes mellitus since its introduction over 40 years ago.

This guidance will describe how to manage a patient with an insulin pump when they present for surgery within Worcestershire Acute Hospitals NHS Trust. It is chiefly intended for elective surgery.

This guideline is for use by the following staff groups :

Pre-operative Assessment Nurses
Diabetes Specialist Nurses
Ward Nurses
Anaesthetists
Theatre Practitioners

Lead Clinician(s)

Philip Harrington	Anaesthetic/ICM Speciality Trainee Anaesthetist
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Approved by Medicines Safety Committee on:	13th October 2021
Review Date: This is the most current document and should be used until a revised version is in place	18th March 2029

Key amendments to this guideline

Date	Amendment	Approved by:
October 2021	New document approved	SCSD/ MSC
12th November 2024	Document extended for 12 months whilst awaiting National Guidelines to inform if changes are required	Dr Harsha Mistry
February 2026	Edited to include new AAGBI guidance on CGM and Closed loop systems.	Dr J Mackie

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Abbreviations

CSII: Continuous Subcutaneous Insulin Infusion
CVRIII or VRIII: Continuous Variable Rate IV Insulin Infusion
CBG: Capillary Blood Glucose

Introduction

Over the past decade, there has been a significant increase in the use of wearable technology to manage diabetes. As such, teams need to be adept at managing these devices. There are currently three main types: continuous glucose monitors; continuous subcutaneous insulin infusions (or pumps); and hybrid closed-loop technology.

Continuous glucose monitors (CGM) measure interstitial glucose and transmit the readings to an electronic device (e.g.mobile telephone) or a specific glucose meter on which it can be read. It is important to appreciate that interstitial glucose lags behind capillary blood glucose (CBG) by several minutes, Their use in the community is increasing.

A **continuous subcutaneous insulin infusion** or **insulin pump** delivers a continuous infusion of rapid-acting insulin and then at mealtimes, the person can administer a bolus of the insulin from the pump based on the carbohydrate content of their meal.

Hybrid closed-loop technology is an amalgamation of continuous glucose monitors and continuous subcutaneous insulin infusion technology, in that the patient wears a sensor that communicates with the insulin pump. These systems maintain glucose concentrations within a target range using a computerised algorithm to automatically adjust the basal rate of insulin and administer corrective doses, though users should still manually programme insulin boluses for meals.

Perioperative use of Continuous Glucose Monitors

Several factors can affect the accuracy of continuous glucose monitors (see table). Consequently, because of potential accuracy and precision issues, reliance on them in patients admitted to hospital cannot currently be advocated. CGM can be left in place and used as adjunct, but treatment decisions should be based on point-of-care capillary/venous glucose if accuracy is in doubt / peri-op / rapidly changing physiology.

Major issue	Detail
Measurement differences	• Continuous glucose monitors measure glucose in the interstitial fluid rather than the blood. Thus, there is a lag for the two compartments to equilibrate. • Alterations to tissue perfusion caused by temperature and changes in hydration.
Sensor-related factors	• Compression: lying on the sensor can cause falsely low glucose readings due to compression. • Sensor placement: where the sensor is placed on the body can impact accuracy, with some sites and positions being more disposed to inaccuracies e.g. abdomen in the prone position • Sensor wear time: accuracy can vary throughout the wear time of a sensor, with some systems being less accurate at the beginning or end of their lifespan. • Calibration issues: errors in calibration can lead to inaccuracies. • Issues with specificity of the sensor and some sensors being triggered by non-glucose molecules too, e.g. acetaminophen (i.e. paracetamol); maltose; ascorbic acid; dopamine; mannitol; heparin; uric acid; hydroxyurea; and salicylic acid

Table: Causes of inaccuracies of continuous glucose monitoring [1]

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Perioperative use of Continuous Subcutaneous Insulin Infusion (Insulin Pumps)

NICE guidelines for diabetes management in the UK recommends that up to 15-20% of people with type I diabetes should qualify for insulin pump therapy [2]. Personal preferences and logistical barriers mean that actual numbers of pump users are not this high but current thinking is that up to 50% of people with type I diabetes will require some form of surgery during their lifetime [3,4]. It therefore follows that healthcare professionals looking after these patients in the perioperative period should have an awareness of how to manage their insulin requirements as well as a framework to help guide this care. This is particularly the case when these patients are unable to manage their therapy themselves [5].

Principles of insulin pump therapy

- The therapy is currently used for patients with an absolute insulin deficiency.
- Insulin is delivered subcutaneously via a small battery-operated device which is programmable.
- A “basal-bolus” regime is followed using short acting insulin only. The pump will deliver a pre-calculated daily quantity of insulin over 24 hours to manage basal rates and is programmed by the patient to deliver additional doses at meal times based on carbohydrate consumed.
- The device may be traditional with tubing attached to a cannula delivery system subcutaneously or may be a “patch pump” with an adhesive pod.
- The cannula is changed every 2-3 days.
- The device may have an inbuilt continuous glucose monitoring system (CGMS).
- As short acting insulin is used, ceasing the pump will render the patient relatively insulin deficient within an hour and absolutely insulin deficient within 4 hours.

The Centre for Perioperative Care (CPOC) recommends that patients continue their CSII in the perioperative period provided that they have a short fasting time (no more than one missed meal) [6]. However, their peri-operative use can be affected by electromagnetic interference; issues with insulin absorption; requirement for Teflonâ needles rather than steel; and the inability of most healthcare practitioners to adjust the settings on the pump safely. This guideline is designed to assist healthcare personnel to manage patients with insulin pumps during the perioperative period.

Perioperative use of Hybrid-Closed Loop Systems

The options for the peri-operative management of diabetes in patients using a hybrid closed-loop system are to:

- switch to the use of variable rate intravenous insulin infusion and recommence hybrid closed-loop technology in a managed fashion (i.e. when the person is stable, eating and drinking, and able to self-manage the pump);
- switch to continuous subcutaneous insulin infusion mode of the hybrid closed-loop technology pump, having ensured all criteria in Table 3 are met;
- continue with hybrid closed-loop technology mode, provided point-of-care glucose monitoring can be undertaken at 30-min intervals, the`target range´ has been adjusted appropriately (normally to 6–10 mmol.l -1 (72–180 mg.dl -1)).

The peri-operative use of hybrid closed-loop technology is in its infancy and cannot yet be advocated routinely outside experienced clinical teams, despite there being case reports and various guidelines

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Perioperative management of Insulin pump therapy

There are a number of aspects to consider when managing perioperative care for patients with insulin pumps. The following guidance applies chiefly to elective surgery with sufficient planning time to make suitable arrangements; emergency surgery will be briefly covered at the end. The guidance can be split into pre-operative, peri-operative and post-operative considerations.

Requisites for safe peri-operative use of CSII (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 CSII. A shared decision making process should occur to determine their preference for the use of the CSII
- Documentation of discussions and decisions made with the person with diabetes.
- Multidisciplinary agreement that continued use of CSII is appropriate.
- Provision to issue patient information leaflet.
- 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 (8.5%).
- 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 TeflonR cannula and not a steel cannula.
- Sufficient TeflonR consumables.
- Ability to monitor CBG regularly (i.e. every 60 minutes) and to monitor capillary blood ketones.
- Ability to replace CSII with a VRIII if necessary.

Pre-operatively

A discussion should occur with the regular diabetes team who cares for the patient. This may not be the local hospital's diabetes team. This is to confirm and establish:

- Patient's ability to self-manage the pump
- The appropriate basal rates and control
- Adequate amount of infusion sets supplied to patient
- The need for an overnight basal assessment prior to surgery. This usually consists of a light carbohydrate meal followed by appropriate insulin administration. Capillary glucose is checked regularly overnight until 11am the following day. Discrepancy between measurements (i.e. of more than 1.7mmol/l) suggests an inappropriate basal regime which may need altering before proceeding with surgery.
- 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 the day of admission

If a patient has frequent CBG readings of below 6mmol/L please consider the below points:

- If the patient usually wakes up in the mornings with a CBG under 6mmol/L ask them to reduce the basal infusion rate to 80% of their normal rate at bedtime
- If the patient usually gets CBG's < 6mmol/L during the day inform the person with diabetes to reduce basal to 80% of normal on awakening on the day of surgery

Discussion with the patient should occur to establish:

- Patient's motivation to continue CSII perioperatively
- An adequate supply of device consumables
- That they have re-sited the device on the day prior to surgery

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- That the device is positioned away from the operative field, at a point distant to the use of diathermy and will be accessible to the anaesthetist.

Importantly, these patients do not need to be on a variable rate IV insulin infusion (VRIII) if nil by mouth (NBM) overnight for theatre the following morning. The pumps are designed to give excellent fasting blood glucose stability (see basal assessment above).

Kidderminster Treatment Centre (KTC)
Patients with insulin pumps can have surgery at KTC as long as the following criteria are met:

- Procedure is minor/intermediate where only one meal is expected to be missed
- Procedure is listed for early on in the list (i.e. 1st)
- The patients usual diabetes team are involved in the decision and give clear guidance on:
  - Appropriate basal rates to be set (including timing)
  - Appropriate plan in case of pump failure or alarm
  - Postoperative control
- The diabetes team at KTC are kept informed of the plan by the individual patient's DSN (bleep 3323 at time of writing).
- Note that KTC cannot manage a VRIII and in the event that one is needed, the patient could require transfer to another site (i.e. WRH or the Alex)

Perioperatively

Major surgery (>2 hours and unlikely to eat/drink within 3 hours post op)

- Patient should remove pump and leave with nominated family member
- A variable rate insulin infusion (VRIII) should be started (see separate guidance on the management of a VRIII). Usually the VRIII should be started approximately 30 minutes before disconnection of the pump (to reduce risks of hyperglycaemia on cessation of pump therapy).
- If likely to remain on VRIII for over 24 hours then discuss with Diabetes team regarding advice on giving a dose of subcutaneous basal insulin. This is to minimise the risk of hyperglycaemia in the post-operative period due to physiological stress and insulin resistance.
- The pump can be restarted once eating and drinking and after discussion with the Diabetes team to co-ordinate starting pump and ceasing VRIII.

Minor surgery (<2 hours/only one meal missed and expected to eat/drink within 3 hours post op)

- Ensure that capillary blood glucose (CBG) is within acceptable range (i.e. ideally between 6-10mmol/L but outside this range may be acceptable depending on clinical circumstances) prior to procedure. If outside of this range then guidance for hypo or hyperglycaemia should be followed respectively.
- Patients with a pump undergoing minor surgery can continue their pump throughout the procedure at the set basal rate
- CBG stable (6-10mmol/L) should be monitored hourly
- If CBG falls below 4mmol/l then should be treated as a hypoglycaemic event (see separate guidance). Because of the relatively slow absorption of insulin from the subcutaneous site, stopping the basal insulin is unlikely to have an effect on glucose control for up to 2 hours and therefore the pump can often safely be left running [3].
- If CBG is recurrently out of these ranges (i.e. below 4 or above 12 mmol/L) and is difficult to control then stop and disconnect pump and convert to VRIII. Do not attempt to adjust settings. Label the pump and store in a secure place to transfer with patient.

Emergency surgery

- Assessment should include CBG, urine and blood ketones and venous/arterial PH

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- Pump should be disconnected 30 minutes after starting a VRIII if this time frame allows (to reduce risks of hyperglycaemia and ketosis when pump is stopped).
- Continue to follow guidance for management of VRIII.

Radiology

- CSII pumps should not be used if screening radiology is required in theatre (see Appendix 1 for table regarding intra-operative radiology)

Alarms

- If the pump alarms then CBG should be monitored every 30 minutes
- If the alarm becomes intrusive to surgery the pump device including the cannula should be removed and stored safely. VRIII should be started.

Post-operatively

- If the pump has been allowed to run, CBG has been in range (target range 6-10mmol/L (6-12mmol/L acceptable)) and no VRIII has been started then CBG should be checked hourly until the patient is able to monitor the pump for themselves. This will likely be the case for a minor procedure.
- If this criteria cannot be met then consider VRIII.
- The patient should be advised to increase the frequency of CBG testing for 2-3 days post operatively.
- Aim to get the person eating and drinking once able to safely self-manage their pump
- Ensure if pump is disconnected that it is transferred back to the ward with the patient

If VRIII has been required then discussion should occur with the Diabetes team to manage restarting of insulin pump therapy.

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Appendix 1: Alterations regarding intra-operative Radiology [3]

Procedure	Recommendation
X-ray	For dental XR pump should be covered by lead apron. For body XR pump should be removed.
CT/MRI	Pump and metal infusion set should be removed
Ultrasound	Pump can remain – transducer not to be pointed at pump
Cardiac catheterization	Pump should be removed
Pacemaker/AED	Pump should be removed
Colonoscopy/OGD	Pump can remain in place
Laser surgery	Pump can remain in place

Appendix 2: Criteria for peri-operative use of subcutaneous insulin infusion technology [1].

Organisational factors	Patient factors	Additional criteria for continuation of hybrid closed-loop technology
Assurance that the proposed surgery will entail a short starvation period with only one missed meal		
Multidisciplinary and patient agreement that continued use of insulin pumps is appropriate		
Avoidance of magnetic resonance imaging		
Patients should be seen before hospital admission by a registered healthcare practitioner who is knowledgeable about the peri-operative use of insulin pumps	No acute metabolic or physiological derangements	Ability to elevate the blood glucose target zone above that set for outpatients
Documentation of discussions and decisions made with the person with diabetes	Where possible aim for elective or expedited surgery	Ability to ensure the sensor is not compressed and has good perfusion
On the day of surgery patients can be reviewed pre- and postoperatively by a registered healthcare practitioner who is knowledgeable about the peri-operative use of insulin pumps	Person with diabetes/carer happy to have their diabetes managed with continuation of subcutaneous insulin infusion technology	Ability to position sensor away from electromagnetic field
Ability to give rescue medicines for hypo and hyperglycaemia	Person with diabetes/carer able to understand instructions	Ability to monitor capillary blood glucose regularly, i.e. every 30 min
Ability to replace subcutaneous insulin pump with a variable rate intravenous insulin infusion if necessary	Optimal pre-operative HbA1c < 69 $mmol.mol^{-1}$ where safe to achieve Ability for the person with diabetes to self-adjust the subcutaneous infusion rate to keep capillary blood glucose 6–10 $mmol.l^{-1}$ Ability to site pump away from the site of proposed surgery and for it be constantly accessible Ability to avoid positioning the insulin pump between the earthing plate and the diathermy Use of a Teflon® cannula (and not a steel cannula) Ability to monitor capillary blood glucose (i.e. every 30–60 min) and to monitor capillary ketones	

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References

[1] Levy, N.A., El-Boghdadly, K., Lobo, D.N., Stubbs, D.J., Avari, P., Buggy, D., Frank, C., Howson, K., Moffett, J., Morris, E., Mustafa, O.G., Nash, G., Scanaill, P.Ó., Procter, S., Rayman, G., Russon, K., Thomas, C., Tinsley, S., Xu, A. and Dhatariya, K. (2026), Peri-operative management of diabetes mellitus: a multidisciplinary consensus statement from the Association of Anaesthetists and the Joint British Diabetes Societies for Inpatient Care group. Anaesthesia. https://doi.org/10.1111/anae.70181

[2] NICE. Diabetes Insulin Pump Therapy – Continuous subcutaneous insulin infusion for the treatment of diabetes. 2008

[3] Diabetes UK. Insulin Pump Therapy Position Status. 2011

[4] Crowley, Kieran et al. Current practice in the perioperative management of patients with diabetes mellitus: a narrative review British Journal of Anaesthesia, Volume 131, Issue 2, 242 - 252

[5] Joint British Diabetes societies for Inpatient Care Group. Self-Management of Diabetes in hospital. Leicester. NHS Diabetes 2012

[6] Ayman G, Dhatariya K, Dhesi J et al. Guideline for Perioperative Care for People with Diabetes Mellitus Undergoing Elective and Emergency Surgery. Centre for Perioperative Care; 2021. Available from: https://cpoc.org.uk/ guidelines-resources-guidelines-resources/guidelinediabetes. [Guideline updated 2023]

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Monitoring Tool

This should include realistic goals, timeframes and measurable outcomes.

How will monitoring be carried out?

Who will monitor compliance with the guideline?

Page/ Section of Key Document	Key control:	Checks to be carried out to confirm compliance with the policy:	How often the check will be carried out:	Responsible for carrying out the check:	Results of check reported to: *(Responsible for also ensuring actions are developed to address any areas of non-compliance)*	Frequency of reporting:
	WHAT?	**HOW?**	**WHEN?**	**WHO?**	**WHERE?**	**WHEN?**
	These are the 'key' parts of the process that we are relying on to manage risk. We may not be able to monitor every part of the process, but we MUST monitor the key elements, otherwise we won't know whether we are keeping patients, visitors and/or staff safe.	What are we going to do to make sure the key parts of the process we have identified are being followed? (Some techniques to consider are; audits, spot-checks, analysis of incident trends, monitoring of attendance at training.)	Be realistic. Set achievable frequencies. Use terms such as '10 times a year' instead of 'monthly'.	Who is responsible for the check? Is it listed in the 'duties' section of the policy? Is it in the job description?	Who will receive the monitoring results? Where this is a committee the committee's specific responsibility for monitoring the process must be described within its terms of reference.	Use terms such as '10 times a year' instead of 'monthly'.

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Contribution List

This key document has been circulated to the following individuals for consultation;

Designation
Alison Hall

This key document has been circulated to the chair(s) of the following committee's / groups for comments;

Committee

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Supporting Document 1 - Equality Impact Assessment Tool

To be completed by the key document author and attached to key document when submitted to the appropriate committee for consideration and approval.

		Yes/No	Comments
1.	**Does the policy/guidance affect one group less or more favourably than another on the basis of:**		
	• Race	n	
	• Ethnic origins (including gypsies and travellers)	n	
	• Nationality	n	
	• Gender	n	
	• Culture	n	
	• Religion or belief	n	
	• Sexual orientation including lesbian, gay and bisexual people	n	
	• Age	n	
2.	**Is there any evidence that some groups are affected differently?**	n	
3.	**If you have identified potential discrimination, are any exceptions valid, legal and/or justifiable?**	n	
4.	**Is the impact of the policy/guidance likely to be negative?**	n	
5.	**If so can the impact be avoided?**	n	
6.	**What alternatives are there to achieving the policy/guidance without the impact?**	n	
7.	**Can we reduce the impact by taking different action?**	n	

If you have identified a potential discriminatory impact of this key document, please refer it to Human Resources, together with any suggestions as to the action required to avoid/reduce this impact.

For advice in respect of answering the above questions, please contact Human Resources.

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Supporting Document 2 – Financial Impact Assessment

To be completed by the key document author and attached to key document when submitted to the appropriate committee for consideration and approval.

	Title of document:	Yes/No
1.	Does the implementation of this document require any additional Capital resources	n
2.	Does the implementation of this document require additional revenue	n
3.	Does the implementation of this document require additional manpower	n
4.	Does the implementation of this document release any manpower costs through a change in practice	n
5.	Are there additional staff training costs associated with implementing this document which cannot be delivered through current training programmes or allocated training times for staff	n
	Other comments:	

If the response to any of the above is yes, please complete a business case and which is signed by your Finance Manager and Directorate Manager for consideration by the Accountable Director before progressing to the relevant committee for approval.

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