

DIABETES MELLITUS (TYPE 1) INPATIENTS USING INSULIN PUMPS

PRACTICE GUIDELINE[®]

DOCUMENT SUMMARY/KEY POINTS

- Patients with Type 1 Diabetes Mellitus (T1DM) who are already wearing an insulin pump may require admission periodically for stabilisation of their diabetes or other unrelated reasons. Understanding how to care for these patients in a ward setting is essential.
- Where a patient with T1DM who is already wearing an insulin pump is admitted the endocrine team must be notified on admission.
- On admission, the Endocrine team must document the insulin pump settings along with the order for insulin which will be used to refill the pump reservoir every 48 or 72 hours depending on the infusion set in use. The Endocrine team will review the insulin pump settings daily and document changes when they occur.
- On admission, the Endocrine team and the nursing staff must establish **who is best placed to operate the pump: the patient or the parent/carer.**
- If the patient is not competent in insulin pump management and the parent/carer cannot be present to operate the insulin pump 24/7, then insulin pump therapy should be ceased, and the patient commenced on multiple daily injections of insulin.
- If the patient/parent/carer (24/7) is deemed competent in managing the insulin pump, then the nursing staff are responsible for supervising all glucose levels and meal bolus entries into the pump. The nursing staff must liaise with the Diabetes Nurse Educator to ensure that they are familiar with the pump and are able to care for the child using the pump.
- Nursing staff must supervise the patient/parent/carer when insulin is delivered for:
 - carbohydrate intake
 - an insulin dose to correct an elevated glucose level.

At the discretion of the Endocrinologist, an IV insulin infusion may be considered an appropriate replacement for insulin pump therapy during admission.

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure & Guideline Committee	
Date Effective:	1 st May 2023	Review Period: 3 years
Team Leader:	Diabetes Nurse Manager	Area/Dept: CHW Endocrinology

CHANGE SUMMARY

- Document due for mandatory review.
- Nursing staff are to supervise all insulin boluses given for meals, snacks and corrections for elevated glucose levels.
- Sensor glucose values via Continuous Glucose Monitoring systems (CGM) cannot be used for clinical decisions while an inpatient (e.g., insulin administration, dose adjustment and hypoglycaemia management). In these instances, a blood glucose level (BGL) is required (fingerstick) using a standard hospital glucometer. Exceptions to this need to be approved by the Endocrine team.
- Hybrid Closed Loop (HCL) pumps have not been evaluated in patients who are undergoing surgery and anaesthesia. As CGM may not be accurate during surgery / anaesthesia and there is limited data about the effect of drugs used during anaesthesia, patients should not be managed in HCL systems during surgery. Refer to:
 - [Fasting and Surgery – Type 1 Diabetes Mellitus \(T1DM\) - CHW](#)
 - [Type 1 Diabetes Mellitus in Children During Surgery and Fasting – SCH](#)

READ ACKNOWLEDGEMENT

- All nursing staff involved in caring for a patient using an insulin pump during an admission must read and acknowledge they understand the contents of this document.

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Introduction

An increasing number of children and adolescents with T1DM are being managed with an insulin pump. Patients with T1DM who are already using an insulin pump may periodically require admission for stabilisation of their diabetes or for other unrelated reasons. The pump delivers insulin in two ways:

1. The basal rate is the rate at which the pump automatically delivers insulin continuously 24hrs a day to keep the glucose levels stable between meals and at night. The basal rate is programmed according to the patient's individual requirements. The background or basal insulin helps to control the glucose released from the liver.
2. The bolus dose is the amount of insulin delivered over a short period of time and is used to cover the carbohydrate content in meals and snacks. A correction bolus can also be administered to lower elevated glucose levels.
3. For some hybrid closed loop pumps (HCL), the doses are automatic, please consult the Endocrine team for advice.

List of Abbreviations

T1DM	Type 1 Diabetes
BGL	Blood Glucose Level
CGM	Continuous Glucose Monitoring
MRI	Magnetic Resonance Imaging
CT	Computed Tomography
HCL	Hybrid Closed Loop

Patients wearing a Continuous Glucose Monitoring system

A continuous glucose monitoring system (CGM) is a small, self-inserted sensing device worn on the body. CGM transmits interstitial glucose levels to an insulin pump screen, or receiver device (for example a smartphone) about current sensor glucose status. Graphs and trend arrows show the direction of glucose values and rate of change, providing users additional information to help with their diabetes management. **It is important to note that the sensor measures the interstitial glucose level, not the blood glucose level.**

A closed loop system is when an insulin pump and CGM are able to manage the glucose level autonomously without input from the pump user. In 2021, hybrid closed loop (HCL) pump systems became available in Australia. Pumps with HCL technology have the ability to function as a basic pump by switching off the HCL function and using manual mode.

CGM has not been evaluated or approved in persons on dialysis or in critically ill patients. It is not known how different medical conditions or medications common to the critically ill population may affect performance of CGM. Sensor glucose levels may be inaccurate in critically ill patients. Medications containing paracetamol/acetaminophen can give a false high reading and there is limited data about the effect of other medications on CGM accuracy.

The guidelines for hospitalised patients are:

- A parent and or ward/diabetes nursing staff need to be available and trained in reverting the pump to manual mode and setting a temporary basal rate if required. If not the pump and CGM should be removed, and the patient commenced on multiple daily insulin injections.
- Sensor glucose values via **CGM cannot be used for clinical decisions** while an inpatient (e.g., insulin administration, dose adjustment and hypoglycaemia management). In these instances, a blood glucose level is required (fingerstick) using a standard hospital glucometer. Exceptions to this need to be approved by the Endocrine team.
- The sensor and transmitter should be removed from the patient before Magnetic Resonance Imaging (MRI), Computed Tomography (CT) scan, or high-frequency electrical heat (diathermy) treatment.
- The sensor and transmitter should be removed from the patient prior to surgery. Medical and nursing staff are required to continue blood glucose monitoring (fingerstick) using a standard hospital glucometer during surgery to guide clinical decisions.
- In some circumstances, following team discussion and with the approval of the treating endocrinologist, CGM may be used in the hospital setting to provide information in addition to fingerstick glucose levels. In these situations, the frequency of fingerstick blood glucose monitoring should be stated in the medical records by the treating endocrinologist and the decision to use CGM should be reviewed at least daily and also at the addition of any new medications or change in clinical situation.

Process on admission to ward

Important: On admission, the Endocrine team and nursing staff must establish who will be responsible and available to manage the pump: the patient or the parent/carer. If the patient is not competent in insulin pump management and the parent/carer cannot be there 24/7, then insulin pump therapy should be ceased, and the patient commenced on multiple daily injections of insulin.

Nursing staff:

- Page the **Endocrine** Team on admission
 - Review the insulin basal rates.
 - Review the patient's insulin to carbohydrate ratio (ICR) and insulin sensitivity factor (ISF)
 - To prescribe the insulin to be used to refill the reservoir every 48 or 72 hours depending on the infusion set in use.
- Fingertick BGLs are to be done before main meals and sensor glucose levels can be used 2 hours post main meals (usually coinciding with a snack) plus 0000 and 0300hrs.
- Ensure that there is adequate insulin in the reservoir and be aware the reservoir cannula and tubing needs to be changed every 48 or 72 hours depending on the infusion set in use. The patient/parent/carer will have been taught by the Diabetes Nurse Educator how to change the cannula and tubing and may have spare supplies available. If stock is not available, nursing staff will contact the Endocrine team to prescribe subcutaneous insulin doses until insulin pump supplies are obtained.
- Supervise the patient/parent/carer when BGL is measured, and insulin is delivered for carbohydrate intake and/or correction dose.
- The patient/parent/carer will have been taught how to count carbohydrates for their commonly consumed and new foods. For hospital inpatient meals at Westmead, carbohydrate amounts are available on the [intranet](#). For inpatient meals at Randwick, a guide to the carbohydrate content of inpatient meals is located on the patient meal order sheet. These can be used to assist with calculating total amounts of carbohydrates for meals to be entered into the pump to enable adequate insulin delivery. All carbohydrate containing meals and snacks need to be counted and preferably entered into the pump 10-15mins preprandial unless advised otherwise by the Endocrine team. A Diabetes Dietitian review can be requested by nursing staff or the Endocrine team.
- The Diabetes Nurse Educator and Diabetes Dietitian will provide regular diabetes education on insulin pump management to the nursing staff on the ward and are available to answer any questions Monday to Friday 9am-5pm.

Nursing care during other procedures whilst an inpatient:

- The insulin pump must be disconnected for X-rays, and CT or MRI scans and not taken into the scan.
- Insulin pumps should not be disconnected, or insulin ceased for more than 2 hours without discussion with the Endocrine team.
- If the patient is Nil by Mouth or planned to be fasting, page the Endocrine team for a management plan for the patient.
- The basal rate plus insulin to carbohydrate ratio (ICR) and insulin sensitivity factors (ISF) should only be adjusted under direction of the Endocrine team.
- HCL pumps have not been evaluated in patients who are undergoing surgery and anaesthesia. As CGM may not be accurate during surgery / anaesthesia and there is limited data about the effect of drugs used during anaesthesia, patients should not be managed in HCL systems during surgery. Refer to:
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Treatment of Hypoglycaemia and Hyperglycaemia

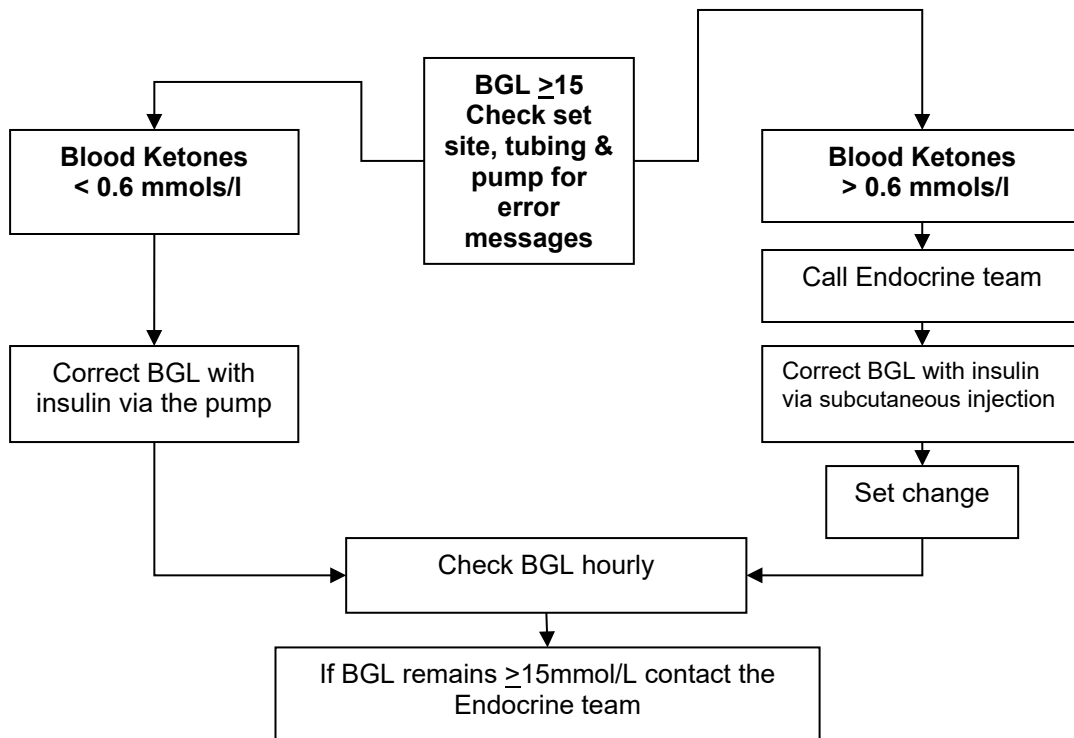
Hypoglycaemia (BGL \leq 4mmol/L)

- Any BGL \leq 4mmol/L needs to be treated as hypoglycaemia, even if the patient is asymptomatic.
- Treatment of hypoglycaemia in patients with insulin pumps is as per the [Hypoglycaemia in Paediatric Diabetes](#)

Hyperglycaemia (BGL \geq 15mmol/L)

- Treatment of Hyperglycaemia in patients with insulin pumps is as per the [Diabetes Management and Insulin Administration](#)
- Check blood for Ketones via ward glucose meter and follow the [Flowchart](#) below.
 - \leq 0.6mmol/L = negative
 - $>$ 0.6mmol/L = positive
- Check the:
 - site for redness, swelling or leaking of insulin.
 - tubing for air bubbles, kinks and for the presence of insulin in the syringe.
- If there is any concern about the site, the tubing, the pump or the insulin, the set should be changed.
- Recheck BGLs hourly. If BGL remains \geq 15mmol/L contact Endocrine team.

Hyperglycaemia Treatment Flowchart



Patients on insulin pumps fasting for surgery or other procedures

- The Endocrine team will determine the approach depending on the individual patient and procedure.
- HCL pumps have not been evaluated in patients who are undergoing surgery and anaesthesia. As CGM may not be accurate during surgery / anaesthesia and there is limited data about the effect of drugs used during anaesthesia, patients should not be managed in HCL systems during surgery.
- Refer to:
 - [Type 1 Diabetes Mellitus in Children During Surgery and Fasting – SCH](#)
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