

Insulin infusion pump management Inpatient guidelines

Statewide Diabetes Clinical Network
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Insulin infusion pump management: Inpatient guidelines

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Purpose

These guidelines have been developed to provide advice and guidance to Queensland Health staff so that individuals whose diabetes is being treated in the outpatient setting with a continuous subcutaneous insulin infusion (CSII) delivered with an insulin pump, can continue to be managed safely with their insulin pump during their hospitalisation.

Background

An insulin pump is a complex electronically-controlled device for the continuous subcutaneous infusion of insulin to patients with type 1 diabetes mellitus. Its advantage over multiple daily insulin injections is that patients can deliver more physiological amounts of insulin between meals and at meal times.

There are many insulin pumps now available and all insulin pumps have different management programs. It is highly unlikely that non-specialised medical or nursing staff will know the exact details of how to program and operate each device and even highly specialised staff within diabetes and endocrine units may not have this knowledge unless they work in clinics where patients using these devices are seen regularly. However, the basic principles of insulin administration using CSII with an insulin pump is not dissimilar to the principles involved in a basal bolus multiple injection insulin regimen. This involves maintaining constant background insulin administration (basal insulin therapy) with boluses of insulin administered when food is consumed (bolus therapy) and corrections being given when blood glucose is out of target.

It is recommended that insulin pumps deliver ultra-short acting analogue insulin (Novorapid, Humalog). There is prospective data confirming that analogue therapy achieves better glycaemic control. There is no long acting insulin administered. Cessation of insulin pump therapy will result in the patient becoming relatively insulin deficient within one hour and absolutely insulin deficient within four hours. There is a major risk of severe hyperglycaemia and ketoacidosis occurring within hours following discontinuation of therapy. Insulin replacement therapy must be commenced immediately (eg IV insulin infusion or intermittent subcutaneous injections) on discontinuation of insulin pump therapy.

Hospital staff should assume, unless otherwise advised, that the only person who can manage the pump during their hospitalisation is the patient, or in the case of children their parent/guardian. Any changes in insulin administration will need to be made by the patient/parent/guardian who must be competent in managing the pump and physically and mentally able to accept and institute these recommendations. These guidelines provide a framework for hospital staff to assess competency, document a patient's suitability to continue on CSII therapy and provide recommendations when pump therapy should be discontinued.



Guidelines

Competency

Any patient who is admitted to hospital using an insulin pump must be assessed for their competency to use their device. If they can demonstrate their physical and mental competency to manage the device, the patient should be allowed to continue on their insulin pump. The Insulin pump management checklist (Attachment 1) should be used as a tool to guide this assessment of the patient's competency to manage the insulin pump during the admission.

On admission to hospital, either to a ward or emergency department, the patient must demonstrate to the satisfaction of the assessing health professional that they have the ability to use the management program of the device and understand how to modify the program. It is acknowledged that the assessing health professional may have no competency in the practical management of the insulin pump. The role of the health professional is to assess the competency of the patient to use the insulin infusion pump.

This will involve asking the patient to demonstrate that they:

1. can open the management menu of the device
2. are able to adjust the basal rate
3. are able to adjust the bolus dose
4. can re-site their pump cannula. This could involve discussing how it is done, rather than actually undertaking the activity at this initial assessment
5. can demonstrate technical competency regarding cannula sites / how they would manage infusion line obstructions / site leaks
6. can undertake appropriate problem solving actions if BGLs are high or low
7. have adequate supplies of infusion sets, spare batteries and the insulin used in the insulin pump available for the anticipated duration of the admission
8. have been performing regular blood glucose monitoring tests (for example, four tests per day).

The diabetes educator or diabetes resource person for the hospital should be notified upon admission of a patient with an insulin pump (Section 4). An urgent consultation should be obtained if there is a concern about competency of the patient to continue on pump therapy. The resource person may be able to advise or rectify any issues or concerns, allowing the patient to continue on their insulin pump.

If the patient (or parent/guardian) cannot competently demonstrate or describe the actions above, the insulin pump should be discontinued. The patient should be placed on an IV insulin infusion or subcutaneous insulin regime (eg, basal/bolus insulin regimen in adults) during their hospitalisation.



Contraindications

The use of the CSII is contraindicated in situations where the patient's safety may be compromised by the physical illness or mental state of the patient.

Absolute contraindications for CSII using an insulin pump are:-

1. patients with an impaired level of consciousness

Note: insulin pump therapy can be continued during anaesthesia (with decreased level of consciousness) as long as the anaesthetist is aware of and willing to manage the pump during anaesthesia.

2. patients with critical illness requiring intensive care
3. patients with major psychiatric disturbance
4. diabetic ketoacidosis
5. patients refusing or unwilling to participate in self-care
6. lack of infusion sets, spare batteries and other equipment required to maintain patient on CSII therapy
7. any other medical circumstance deemed unsuitable by the supervising medical officer.

If the patient presents with any of above items the insulin pump must be discontinued and the device managed according to the hospital's policy for storage of patient valuables. When storing the pump be sure to remove the battery from the device to prevent ongoing pump alarms. The patient should be placed on an IV insulin infusion or subcutaneous insulin regime (eg basal/bolus insulin regimen in adults) during their hospitalisation.

In the case of Item 7, an urgent discussion of the patient's condition and management with the diabetes specialist, diabetes educator or diabetes resource person for that hospital should be considered.



Documentation

Before a patient continues on CSII as an inpatient, the following criteria must be documented.

1. It must be clearly written in the medical record and on the blood glucose monitoring form that the patient is on an insulin pump.
2. The brand name and model of the pump must be written in the medical record.
3. The type of insulin used in the insulin pump must be identified and recorded in the blood glucose monitoring form.
4. The current basal and bolus insulin doses must be documented in the medical record. Ideally the pump data would be downloaded and the print out stored in the medical chart for reference.
5. That competency has been assessed and deemed satisfactory, as per Section 1.
6. The patient agrees to notify the medical staff of any changes they make to their insulin pump.

Consultations

The following health professionals should be consulted:

- endocrinologist or physician with interest in diabetes
- diabetes educator or diabetes resource person trained in insulin pump management
- dietitian.

Insulin adjustment

Changes to the patient's insulin therapy may be made at any time by the patient provided the change is notified to the medical staff.

Any change to the insulin regimen recommended by the medical staff will be documented in the medical record and confirmed by the patient at the time of implementation.



Blood glucose monitoring

Patients on an insulin pump should perform a minimum of four blood glucose tests per day. These should be performed before each main meal and before going to sleep at night.

In patients with less satisfactory control, six tests per day should be performed (one test before and two hours after each of the three main meals). An overnight test (eg 0200hrs) may be necessary.

Additional blood glucose levels may be undertaken at any time by the patient. Additional tests may also be performed at the request of the medical officer or nursing staff when clinically indicated.

The number of tests performed each day can only be reduced on the orders of the medical officer and can never be reduced to less than four tests per day.

Continuous glucose monitoring systems

Continuous glucose monitoring systems (CGMS) measure level of glucose in the interstitial fluid and gives a reading every 5 mins. The CGMS works through a sensor inserted under the skin, the glucose level is interpreted in a transmitter and then sent to a receiver. The receiver can either be a specific receiver, the insulin pump or a phone depending on the make / model of the transmitter.

The CGMS sensor is disposable and changed according to manufacturer recommendations (generally every 6 to 7 days). The sensors require calibration minimum of 12 hourly to promote accuracy this is done using a capillary blood glucose check.

CGMS sensor readings provide excellent information regarding glucose trends and patterns. At the time of writing only one sensor (Dexcom5) has approval with the Therapeutic Goods Administration (TGA) and is deemed accurate enough to be used for the calculation of insulin doses, all other CGMS have not received TGA approval to do so and capillary blood glucose level must still be done for this purpose.

During a hospital admission, especially in times of rapidly changing conditions and in and episodes of diabetic ketoacidosis, CGMS should not be used for diabetes management.



Device management

The patient or guardian:

- is responsible for ensuring the correct operation of the insulin pump
- will rotate the infusion set consistent with the recommendations for the device. This will be every three days, unless other documentation is provided
- will make the adjustments to the insulin pump program
- will be responsible for all bolus dose administration.

If the patient is not capable of undertaking these actions, the insulin pump must be discontinued.

Operations and procedures

The use of the CSII in operating theatres and procedure rooms is not contraindicated. Its use must be considered carefully in consultation between the anaesthetist, surgeon, physician, diabetes educator and patient. The outcomes of discussion about the use of insulin pumps during operations and procedures should be documented in the Insulin pump management checklist (Appendix 1) and in the patient's chart. By delivering stable and consistent insulin administration over hours the insulin pump can provide excellent peri-operative blood glucose control. In the basal infusion mode only, it can be considered equivalent to very long acting insulin.

As with all patients with diabetes undergoing surgery, patients who are unconscious need to be monitored carefully during and after their surgical procedure. Their blood glucose should be measured frequently while their conscious state is impaired.

Patients continuing on CSII peri-operatively

- The patient (or parent/guardian) must consent to continuing on insulin pump therapy peri-operatively.
- CSII and IV insulin therapy should not run at the same time.
- The infusion site must be placed away from the operation site with consideration also given to where a diathermy pad may be placed. Ensure the insertion cannula is plastic not metal. If the pump is to be used during surgery, the patient must replace metal cannulas with plastic insertion cannulas before any surgical procedures that may involve diathermy are performed.
- An identification tag must be attached to the patient that states that the patient is using an insulin pump. This should be sited in a readily visible position appropriate for the procedure to be undertaken.
- The anaesthetist must have access to the insulin pump during surgery to enable it to be turned off or disconnected, if necessary.



- The patient's BGLs must be monitored every hour peri-operatively until they have satisfactorily regained consciousness and the patient (or parent/guardian) is capable of making decisions regarding managing their insulin pump.
- In the event of the blood glucose levels increasing to an unsatisfactory level peri-operatively, an IV insulin infusion should be commenced and the insulin pump turned off, or disconnected.
- In the event of the BGL levels falling below 4mmol/l peri-operatively, the insulin pump must be turned off and/or disconnected. The hypoglycaemia should be treated with IV glucose.

Once euglycaemia is restored, there are three choices regarding recommencement of the CSII:

1. Recommence the pump at a lower insulin infusion rate (if the medical staff are able to program the device). Consideration should be given to using a temporary basal rate rather than adjusting the usual basal rate. This offers more flexibility and may avoid confusion if basal settings are not restored to usual when the patient has recovered.
2. Recommence the pump at the usual basal rate with a higher IV glucose infusion rate to prevent further episodes of hypoglycaemia.
3. Leave the pump off and commence an IV insulin infusion to control the patient's BGLs.

The use of CSII in major procedures should be only considered in rare circumstances due to the strong probability that an adjustment to the patient's insulin therapy will be required during the prolonged peri-operative period. Discontinuation of the insulin pump and commencement of IV insulin therapy is recommended in this situation.

Patients not continuing on CSII peri-operatively

Patients whose insulin pump is discontinued prior to surgery WILL require either an intravenous insulin infusion or subcutaneous therapy according to the hospital's peri-operative type 1 diabetes management guidelines. Discontinuation of the insulin pump for even short periods of time with no alternative source of insulin will result in the rapid development of hyperglycaemia.

The CSII can be re-commenced when:

1. the patient has regained full consciousness, and
2. it is considered medically appropriate.



Other circumstances

The insulin pump may need to be discontinued temporarily during a number of circumstances during hospitalisation. In this situation, discontinuation of the insulin pump for more than 30 minutes may result in significant hyperglycaemia.

Such circumstances where the insulin pump needs to be temporarily disconnected include:

- any radiological investigation (pump must be removed)
- CT scan (pump must be removed)
- MRI scan (pump must be removed, including metal cannula)
- physiotherapy (depending on the therapy)
- hydrotherapy (even if the pump is labelled as water-proof).

Patients whose insulin pump needs to be discontinued for longer than one hour may need to be considered for an injection of subcutaneous insulin, eg subcutaneous soluble insulin (Actrapid, Humulin R, Humalog, Novorapid or Apidra) to cover their short term requirements. Alternatively, the pump can be discontinued for up to two hours at the discretion of the treating doctor if the patient is clinically stable and blood glucose levels are being monitored regularly. Upon recommencement of the pump, blood glucose should be rechecked and if needed a correction bolus can be given.

Patients needing to be regularly disconnected from their insulin pump should be considered for basal/bolus subcutaneous insulin injection therapy.

Paediatrics

The continuation of CSII in a child in hospital needs to be considered carefully in consultation between the patient, their parent(s) or guardian and their medical team. In the circumstances that the guardian or parent is responsible for the management of the insulin pump, the medical officer must be satisfied that the responsible person can satisfy all the criteria listed in this document. This decision may be made in consultation with a credentialed diabetes educator, when appropriate.

Additionally, the parent or guardian must be able to stay with the patient at all times during the admission so that adjustments to the insulin pump can be made at any time.

If the above conditions cannot be met, the insulin pump should be discontinued and subcutaneous insulin injection should be commenced.



Appendices

| | | | | | | | | | | | |
|--|------------------------------|---|---|-----------|--------------|----------------------------------|--------------|------------------|--------------|--------|--------------|
|  Queensland Government | | (Affix patient identification label here) | | | | | | | | | |
| Insulin pump management checklist Facility: _____ | | URN: _____ | | | | | | | | | |
| | | Family Name: _____ | | | | | | | | | |
| | | Given Names: _____ | | | | | | | | | |
| | | Address: _____ | | | | | | | | | |
| | | Date of Birth: _____ Sex: <input type="checkbox"/> M <input type="checkbox"/> F | | | | | | | | | |
| This form to be completed by medical officer/diabetes educator during patient admission to hospital. | | | | | | | | | | | |
| Name of medical officer/ diabetes educator | | Date: _____ | | | | | | | | | |
| Step 1 | | | Outcome | | | | | | | | |
| Contact diabetes educator (if available in your facility) | No <input type="checkbox"/> | Yes <input type="checkbox"/> | | | | | | | | | |
| Contact the endocrinologist or facility where the pump was initiated to seek advice | No <input type="checkbox"/> | Yes <input type="checkbox"/> | | | | | | | | | |
| Step 2 – Assessing patient safety | | | | | | | | | | | |
| Does the patient have any of the following: | | | | | | | | | | | |
| Impaired consciousness | No <input type="checkbox"/> | Yes <input type="checkbox"/> | If Yes to any question: 1. Discontinue the insulin pump: ask the patient or contact the pump manufacturer's help line for assistance <table border="1" data-bbox="746 1160 1077 1261"> <tr> <td>Medtronic</td> <td>1800 668 670</td> </tr> <tr> <td>Dana (limited support available)</td> <td>1800 451 737</td> </tr> <tr> <td>Accu-check Roche</td> <td>1800 251 816</td> </tr> <tr> <td>Animas</td> <td>1300 851 056</td> </tr> </table> 2. The patient should be placed on an IV insulin infusion or subcutaneous insulin regimen while they are in hospital 3. Please refer to the Insulin Subcutaneous Order and Blood Glucose Record for guidance | Medtronic | 1800 668 670 | Dana (limited support available) | 1800 451 737 | Accu-check Roche | 1800 251 816 | Animas | 1300 851 056 |
| Medtronic | 1800 668 670 | | | | | | | | | | |
| Dana (limited support available) | 1800 451 737 | | | | | | | | | | |
| Accu-check Roche | 1800 251 816 | | | | | | | | | | |
| Animas | 1300 851 056 | | | | | | | | | | |
| A critical illness requiring intensive care | No <input type="checkbox"/> | Yes <input type="checkbox"/> | | | | | | | | | |
| A major psychiatric disturbance or suicidal tendencies | No <input type="checkbox"/> | Yes <input type="checkbox"/> | | | | | | | | | |
| Diabetic ketoacidosis | No <input type="checkbox"/> | Yes <input type="checkbox"/> | | | | | | | | | |
| Lack of infusion sets, spare batteries, insulin and any other equipment required to maintain the insulin pump (these supplies are not stocked by the hospital) | No <input type="checkbox"/> | Yes <input type="checkbox"/> | | | | | | | | | |
| An unwillingness to manage the pump while an inpatient | No <input type="checkbox"/> | Yes <input type="checkbox"/> | | | | | | | | | |
| Any other medical circumstances deemed unsuitable by the supervising medical officer | No <input type="checkbox"/> | Yes <input type="checkbox"/> | | | | | | | | | |
| Step 3 – Assessing patient competency | | | | | | | | | | | |
| Can the patient (or parent or guardian) demonstrate that they can correctly operate the insulin pump | Yes <input type="checkbox"/> | No <input type="checkbox"/> | If No to any question: 1. Discontinue the insulin pump: ask the patient or contact the pump manufacturer's help line for assistance 2. The patient should be placed on an IV insulin infusion or subcutaneous insulin regime while they are in hospital 3. Please refer to the Insulin Subcutaneous Order and Blood Glucose Record for guidance | | | | | | | | |
| Can open the management menu of the device | Yes <input type="checkbox"/> | No <input type="checkbox"/> | | | | | | | | | |
| Are able to adjust the basal rate | Yes <input type="checkbox"/> | No <input type="checkbox"/> | | | | | | | | | |
| Are able to adjust the bolus dose (make adjustments to the program and bolus dose administration) | Yes <input type="checkbox"/> | No <input type="checkbox"/> | | | | | | | | | |
| Demonstrate technical competency regarding cannula sites / how to manage infusion line obstruction / site leaks | Yes <input type="checkbox"/> | No <input type="checkbox"/> | | | | | | | | | |

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Version and date here

INSULIN PUMP MANAGEMENT CHECKLIST



| | | | |
|--|------------------------------|-----------------------------|--|
| Can undertake appropriate problem solving actions if BGLs are high or low | Yes <input type="checkbox"/> | No <input type="checkbox"/> | |
| Have adequate supplies of infusion sets, spare batteries and enough insulin for the length of their hospital stay? Repeated above? | Yes <input type="checkbox"/> | No <input type="checkbox"/> | |
| Have been performing regular blood glucose monitoring tests, that is, 4 per day | Yes <input type="checkbox"/> | No <input type="checkbox"/> | |
| The patient agrees to notify the medical staff of any changes to their insulin pump. | Yes <input type="checkbox"/> | No <input type="checkbox"/> | |
| If the parent or guardian is to be responsible for the insulin pump, then they must stay with the patient at all times | Yes <input type="checkbox"/> | No <input type="checkbox"/> | |
| Rotate the infusion set with the recommendations of the device | Yes <input type="checkbox"/> | No <input type="checkbox"/> | |
| Understands the pump will be discontinued if medically indicated | Yes <input type="checkbox"/> | No <input type="checkbox"/> | |

Step 4 – Operations and procedures

| Discuss use of insulin pump in operating theatre and procedure room with: | | | Outcome |
|---|-----------------------------|------------------------------|---------|
| Anaesthetist | No <input type="checkbox"/> | Yes <input type="checkbox"/> | |
| Surgeon | No <input type="checkbox"/> | Yes <input type="checkbox"/> | |
| Physician | No <input type="checkbox"/> | Yes <input type="checkbox"/> | |
| Diabetes educator | No <input type="checkbox"/> | Yes <input type="checkbox"/> | |
| Patient | No <input type="checkbox"/> | Yes <input type="checkbox"/> | |

Step 5 – Documentation

1. Before the patient continues on the insulin pump as an inpatient, the following must be documented in the patient's medical record
 - a. brand name and model of insulin pump
 - b. type of insulin used
 - c. total daily insulin dose
 - d. target BGLs
 - e. insulin : carbohydrate ratio
 - f. correction factor (insulin sensitivity)
2. Document any changes to the insulin regimen recommended by medical staff during this admission in the medical record and confirmed by the patient at the time of implementation.
3. Complete the Insulin Subcutaneous Order and Blood Glucose Record (or equivalent form) stating that the patient is self-managing and the frequency of BGLs. Initial BGL frequency is standard if BGLs stable. If BGLs unstable frequency is standard plus 2 hours post-meals and 0200hours.

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References

Policy: Use of Continuous Subcutaneous Insulin Infusion (Insulin Pump) Therapy in the Hospital: Shore Health System, University of Maryland Medical System

Dalton M, Klipfel L, Carmichael K. 2006, 'Safety Issues: Use of Continuous Subcutaneous Insulin Infusion (CSII) Pumps in Hospitalised Patients', Hospital Pharmacy, vol. 41, no.10, pp956-969.

Cook C, Boyle M, Cisar N, Miller-Cage V, Bourgeois P, Roust L, Smith S, Zimmerman R. 2005 'Use of Continuous Subcutaneous Insulin Infusion (Insulin Pump) Therapy in the Hospital Setting: Proposed Guidelines and Outcome Measures'. The Diabetes Educator, vol 31, pp849-857.