Guidelines for the Safe Management of Insulin Pump Therapy in Hospital

Diabetes Obesity Nutrition Strategic Clinical Network

December 22, 2016
# Table of Contents:

1. Background........................................................................................................................................... 3  
2. Primary Objective ............................................................................................................................... 3  
3. Key Message ......................................................................................................................................... 3  
4. Insulin Pump Terminology ..................................................................................................................... 4  
5. Procedure for the Safe Self-Management of Insulin Pump Therapy in Hospital ............................... 5  
   Steps for Safe Self-Management of Insulin Pump in Hospital ................................................................. 5  
6. Algorithm for Assessing Self-Management of Insulin Pump in Hospital ........................................... 6  
7. Criteria for Self-Management of Insulin Pump ..................................................................................... 7  
8. Self-Management Terms for and Expectations of Patients .................................................................. 8  
   Required Forms and Order Set for Self-Management of Insulin Pump Therapy in Hospital .......... 10  
9. Patient Agreement to Self-Manage Insulin Pump In-Hospital ............................................................. 11  
10. Insulin Pump Information Sheet ......................................................................................................... 13  
11. In-Hospital Orders for Self-Management of Insulin Pump ................................................................. 14  
12. Insulin Pump Therapy Patient Bedside Logbook ............................................................................... 15  
   Other Tools:  
13. Guidelines for Management of Insulin Pump Therapy Emergencies .............................................. 16  
14. Algorithm for the Safe Use of Insulin Pump during Procedures and Surgery ................................. 18  
15. Guidelines for Managing Pump during Radiologic Procedures ......................................................... 19  
16. Guidelines for Switching between Insulin Pump Therapy and sc Insulin or IV insulin ................ 20  
   Switching from Insulin Pump to Subcutaneous (sc) Basal Bolus insulin ............................................. 20  
   Switching from Subcutaneous Basal/Bolus Insulin Back to Insulin Pump ........................................... 21  
   Switching from IV Insulin Back to Insulin Pump .................................................................................. 21  
17. Guidelines for Managing the Insulin Pump in a Pregnant Woman ................................................... 22  

Appendices:  
Appendix 1: Safer Practice Notice .......................................................................................................... 24  
Appendix 2: IPT Working Group Members and Content Contributors .................................................. 25  
Appendix 3: References ............................................................................................................................ 26  
Appendix 4: Provincial In-Patient Diabetes Management Initiative Pictogram ........................................ 27  

We would like to acknowledge the numerous individuals who had input into developing these guidelines including: Adult and Pediatric Endocrinologists, General Internal Medicine Specialists, Anesthesiologists, Diabetes Educators, Obstetricians, Patients, Nurses, Dietitians, Pharmacists, and Emergency room clinicians (see Appendix 2 for working group membership).
1. Background

Insulin pump therapy use is increasing in Alberta. The Alberta Health Insulin Pump Therapy Program (AH IPT), launched on June 1, 2013, provides funding support to children and adults for insulin pump and/or insulin pump supplies. Funding support is for individuals who meet established eligibility criteria. For more information on the AH IPT, please visit: http://www.health.alberta.ca/services/insulin-pump-therapy-program.html. With growing pump use, health care providers in hospital and emergency settings will see increasing numbers of individuals using pump therapy.

These guidelines have been created by the Diabetes Obesity Nutrition Strategic Clinical Network (DON SCN), Insulin Pump Therapy (IPT) working group. They have been developed to assist providers (including non-diabetes specialists) in caring for patients with insulin pumps safely and effectively during procedures and hospital encounters. These guidelines also support patients on the insulin pump to continue to use their pumps in hospitals across Alberta, where appropriate, and advocate for self-management (by the patient or family member). They also guide the clinician in the hospital environment on how to transition the patient to alternate insulin therapy, when the patient is unable to self-manage with their insulin pump.

The safe management of Insulin Pump Therapy in acute care guidelines are part of a larger Diabetes Inpatient Management initiative (see Appendix 4).

2. Primary Objective

Patient Safety

To ensure that patients with Type 1 diabetes on the insulin pump are managed in a safe and effective manner during procedures and hospital encounters

3. Key Message

“If pump stopped, must replace basal insulin within 2 hours to prevent Diabetic Ketoacidosis (DKA)”
4. Insulin Pump Terminology

**Key Message:** “If pump stopped, must replace basal insulin within 2 hours to prevent Diabetic Ketoacidosis (DKA)”

<table>
<thead>
<tr>
<th>Continuous subcutaneous insulin infusion (CSII) pump (also known as insulin pump)</th>
<th>A battery operated programmable device that delivers only rapid-acting insulin 24 hours a day. The insulin is held in a reservoir and is delivered through a removable soft cannula (or needle) inserted into the subcutaneous layer of the skin, which is changed every 48-72 hours, or sooner as needed. With most pumps, this cannula is connected to a plastic tubing (infusion set) that is attached to the pump where the insulin is held. Other pumps use an insulin-containing pod taped directly to the skin (the pod holds the insulin and a handheld device is used for programming the pump). The insulin pump is programmed to deliver basal and bolus insulin.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal rate/basal insulin infusion</td>
<td>The pump delivers small amounts of insulin in a continuous fashion. This continuous background insulin infusion is measured in units/h. Rates are variable and differ between individuals and differ across a 24-h period within the same individual. Some individuals have different basal profiles for different times or activities (e.g. work vs. non-work days, exercise, illness, etc.). Only rapid acting insulin is used in the pump. There is no long or intermediate-acting insulin is used in the pump.</td>
</tr>
<tr>
<td>Bolus insulin</td>
<td>This is the amount of insulin given for a meal or snack. The patient determines this dose based on the estimated amount of carbohydrates to be consumed for that meal/snack and is calculated from their individual Insulin:Carbohydrate ratio (ICR). EXAMPLE: ICR 1:10 = 1 unit of insulin/10g of carbohydrate</td>
</tr>
<tr>
<td>Correction insulin (and Insulin Sensitivity Factor)</td>
<td>The anticipated amount of insulin needed to correct for hyperglycemia. This is based on the Insulin sensitivity factor (ISF). Individualized ISF allows calculation of a correction dose expected to reduce glucose by $X$ mmol/L EXAMPLE: ISF = 2.5, 1 unit of insulin should reduce glucose by 2.5 mmol/L</td>
</tr>
<tr>
<td>Continuous Glucose Monitoring System (CGM)</td>
<td>Some pumps have the ability use a CGM, which is able to: 1) Assess interstitial glucose every 5 min 2) Alert the user of high or low glucose readings 3) Alert the user of rapid changes in glucose 4) Temporarily suspend insulin delivery if a low glucose alert does not result in user acknowledgement (available with Medtronic pump) This technology is rapidly growing and changing. At the present time, the glucose readings provided are used to prompt capillary glucose testing and rate of change indicators can aid user in insulin self-adjustment. Currently this technology does not eliminate the need for confirmation of glucose by capillary testing prior to insulin adjustment. CGM may be in use without the alert or suspend features enabled.</td>
</tr>
</tbody>
</table>
5. Procedure for the Safe Self-Management of Insulin Pump Therapy in Hospital

Purpose: To ensure safe and effective administration of insulin for patients with diabetes using their own external continuous subcutaneous insulin infusion pump during procedures and hospital encounters.

Enacted by: Nurse, MD or other prescriber

Steps for Safe Self-Management of Insulin Pump in Hospital

1) MD or prescriber must assess patient’s ability to self-manage with the insulin pump using the following tools:
   a) Algorithm for Assessing Self-Management of Insulin Pump in Hospital (see Section 6)
   b) Criteria for Self-Management of Insulin Pump (see Section 7)
   c) Self-Management Terms for and Expectations of Patients (see Section 8)

2) If a patient is appropriate for self-management of the insulin pump in hospital:
   a) Patient (guardian if under age 18) must read, agree and sign the Patient Agreement to Self-Manage Insulin Pump In-Hospital (see Section 9). The completed form is placed into chart

   b) Patient (guardian/caregiver if under age 18) must complete the Insulin Pump Information Sheet (AHS form # 20114) (see Section 10). The completed form is placed into chart

   c) MD or prescriber must complete the In-Hospital Orders for Self-Management of Insulin Pump (AHS form # 20102) (see Section 11). The completed form is placed into chart

   d) Patient (guardian/caregiver if under age 18) must complete the In Hospital Insulin Pump Therapy Patient Bedside Logbook daily (AHS form #20189) (see Section 12)

   e) Nurse to review and sign the In Hospital Insulin Pump Therapy Patient Bedside Logbook (AHS form #20189) at the end of each shift. The completed form is placed into chart daily.

   f) Nurse will test blood sugars as ordered (minimum qid), document in the patients chart and will share result with patient.

3) The patient must be assessed daily by the most responsible physician or prescriber, to ensure that they continue to meet criteria for self-management.

4) If they no longer meet criteria for self-management they are to be switched to an alternate regime of insulin (see Section 16)
6. **Algorithm for Assessing Self-Management of Insulin Pump in Hospital**

*Key Message:* “If pump stopped, must replace basal insulin within 2 hours to prevent Diabetic Ketoacidosis (DKA)”

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**Flowchart Description**

- **Insulin Treated Diabetes?**
  - Yes: **On Insulin Pump?**
    - Yes: **Meets Criteria to Continue Pump?**
      - Yes: Patient May Continue to Use Pump
      - No: **Stop Insulin Pump and Switch to Appropriate Alternate Insulin Prescription (Basal-Bolus or IV Insulin)**
    - No: Alternate Insulin Regime (Home Regime, Basal-Bolus, or IV Insulin)
  - No: Continually Reassess

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*Guidelines for the Safe Management of Insulin Pump Therapy in Hospital*
*Diabetes Obesity Nutrition SCN December 22, 2016*
7. **Criteria for Self-Management of Insulin Pump**

Patient is able to self-manage if all of the following criteria are met:
*(Attending MD responsibility to assess)*

1) Mentally  
   a) Alert and oriented x 3  
2) Physically  
   a) Has no physical/dexterity limitations  
   b) Alternatively, if patient unable to self-manage, a non-health system caregiver (i.e. family member/guardian) is available to provide support/assistance to manage insulin pump 24 hours/day  
3) Medically stable  
4) No identified reasons for *pump discontinuation*  

*Criteria for pump discontinuation:*
1) Cognitive or psychological limitations  
   a) Altered, deteriorating or fluctuating changes to state of consciousness and/or cognitive status, including use of medications that may interfere with cognition or may be sedating (e.g. narcotics)  
   b) Psychiatric illness that interferes with the patient's ability to self-manage (at risk of self-harm/suicide)  
2) Medical conditions:  
   a) **DKA, or persistent unexplained hyperglycemia**  
   b) Persistent/recurrent severe hypoglycemia  
   c) Critically ill (sepsis, trauma) and needs intensive care  
   d) Other inter-current illnesses where use of the insulin pump is risky or non-effective, as determined by the medical staff  
3) Pump functionality or performance limitations:  
   a) Pump not functioning  
      i) Hyperglycemia fails to respond to appropriate action (bolus insulin)  
   b) Insufficient pump supplies (hospital will not provide)  
   c) Physical limitations to using the insulin pump  
4) Refusal or unwillingness to participate in self-care or to agree to self-management terms  
5) Non-health system guardian or caregiver support/assistance (for patients under 18), required to manage insulin pump, is **not available 24 hours/day**
8. **Self-Management Terms for and Expectations of Patients**  
(All of the following must be met):

1) *Does not meet any criteria for discontinuation of pump* (see Section 7)

2) Patient will be required to:
   a) **Provide all pump settings** on the *Insulin Pump Information Sheet* (AHS form # 20114)  
      (see Section 10)
      i) Basal rate settings
      ii) Insulin:carbohydrate ratio (ICR) settings
      iii) Insulin sensitivity factor (ISF) settings
      iv) Average total daily dose, percent basal
         (1) Medtronic: main menu>utilities>daily totals
         (2) Animas Ping & Vibe: main menu > history >total daily dose
         (3) Roche Combo: my data>daily totals
         (4) Omnipod: home screen>my records>insulin delivery
      v) Active insulin on board and glucose targets
      vi) If using auto-off feature
      vii) If using a Continuous Glucose Monitor (CGM) sensor – report if low glucose suspend is on or off
   
   b) **Provide all necessary supplies to run insulin pump (no supplies provided by AHS)**
      i) Insulin pump
      ii) Insulin cartridge (reservoir or pods)
      iii) Tubing and infusion sets
      iv) Batteries (plus extra) for the pump
      v) Dressings (if applicable)
      vi) Insulin – only if non-formulary [glulisine (Apidra®)]
   
   c) **Change the infusion set every 48-72 hours, or sooner as needed for:**
      i) Skin problems
      ii) Two blood glucose readings greater than 14 mmol/L in 4 hours
   
   d) **Allow testing of blood sugar by hospital staff** a minimum 4x/day (prior to meals and bedtime) using hospital meter
      i) Patient may test more often using their own meter/CGM
      ii) Continuous glucose monitoring (CGM) use does not negate the need for capillary testing
   
   e) Check for **capillary ketones** or **urine ketones** if BG values ≥ 14 mmol/L (hospital to provide)
   
   f) Complete **Insulin Pump Therapy Patient Bedside Logbook** (AHS form #20189)  
      including CBG results, ketone testing results, meal bolus and correction doses given, basal rate, infusion set changes and when pump suspended/reconnected.
g) Patient must contact nursing staff if (any of the following situations arise):
   i) Experiencing any signs and symptoms of low blood sugar
   ii) Blood sugar less than 4mmol/L
   iii) Blood sugar 14mmol/L or greater
   iv) For pregnant women; when the majority of blood sugar readings are over 7mmol/L
   v) There is a problem with their pump and/or if they have called the pump company’s 24 hour “1-800 assistance line”
   vi) If they feel they can no longer self-manage the pump

3) Patient understands that the **pump may be discontinued** and a different method of insulin delivery will be provided for any of the following:

   a) Physician or Nurse Practitioner’s order

   b) Not physically, emotionally or mentally capable of managing the insulin pump at the time

   c) Procedures with expected electromagnetic field exposure:
      i) Radiologic procedures (other than ultrasound)
      ii) MRI (NOTE: remove metal cannula for MRI – found on some pump insertion sets and CGM systems)
      iii) CT scan
      iv) Nuclear Stress Test (just for the scan, not the exercise component)
      v) PET scans
      vi) Cardiac catheterization
      vii) Procedures requiring a general anesthetic
      viii) Electric shock for defibrillation (cardioversion)

   d) Other reasons deemed necessary by attending physician or medical staff where the use of the insulin pump is risky or non-effective

   e) Patient does not agree or adhere to the self-management terms above
Required Forms and Order Set for Self-Management of Insulin Pump Therapy in Hospital

The following 4 documents/forms are required when the patient is self-managing their insulin pump in the hospital:

1. **Patient Agreement to Self-Manage Insulin Pump In-Hospital** (AHS form # 20369)
   To be completed by patient (guardian if under age 18) and placed on the patient chart
   (see Section 9 or for a printable form, see [http://www.albertahealthservices.ca/frm-20369.pdf](http://www.albertahealthservices.ca/frm-20369.pdf))

2. **Insulin Pump Information Sheet** (AHS form # 20114)
   To be completed by patient (guardian/caregiver if under age 18) and placed on the patient chart
   (see Section 10 or for a printable form, see [http://www.albertahealthservices.ca/frm-20114.pdf](http://www.albertahealthservices.ca/frm-20114.pdf))

3. **In-Hospital Orders for Self-Management of Insulin Pump** (AHS form # 20102)
   Completed by MD or other prescriber and placed on the patient chart
   (see Section 11 or for a printable form, see [http://www.albertahealthservices.ca/frm-20102.pdf](http://www.albertahealthservices.ca/frm-20102.pdf))

4. **Insulin Pump Therapy Patient Bedside Logbook** (AHS form #20189)
   To be completed by patient (guardian/caregiver if under age 18). Nurse to sign at the end of every shift to confirm logbook has been completed. Nurse to review and file in patient chart each morning at 0700h.
   (see Section 12 or for a printable form, see [http://www.albertahealthservices.ca/frm-20189.pdf](http://www.albertahealthservices.ca/frm-20189.pdf))
9. Patient Agreement to Self-Manage Insulin Pump In-Hospital

(AHS form # 20369)

To be completed by patient (guardian if under age 18) and placed on the patient chart

Patient Agreement to Self-Manage
Insulin Pump In-Hospital

(To be read and signed by patient / guardian and placed in patient chart)

For your safety and optimal medical care during hospitalization, we request that you review this form outlining what is expected of you in hospital to self-manage your diabetes with your insulin pump. If you feel that you cannot carry out these responsibilities, we would like to treat your diabetes with insulin injections and/or intravenous insulin and discontinue the use of your insulin pump.

These are the responsibilities for self-management of your insulin pump during your hospital stay:

1) Understanding the potential risk of using your insulin pump in the hospital:
   a) high and low blood glucose
   b) diabetic ketoacidosis; and
   c) infection.

2) Completing the Insulin Pump Information Sheet (Form # 20114) which will provide all pump settings to your Physician or most responsible Health Practitioner.

3) Providing all necessary supplies to run your insulin pump:
   a) insulin pump;
   b) insulin cartridge or pods;
   c) tubing and infusion sets;
   d) extra batteries for the pump;
   e) dressings (if applicable); and
   f) insulin – only if non-formulary such as [glulisine (Apidra®)].

4) Changing the infusion set every 48-72 hours or sooner as needed for:
   a) skin problems, or
   b) if two blood glucose readings are greater than 14 mmol/L in 4 hours.

5) Allowing hospital staff to test your blood sugar a minimum of 4 times per day (prior to meals and bedtime) using a hospital meter:
   a) You may test more often using your own meter /continuous glucose monitor
   b) If using a continuous glucose monitor; you must still do hospital meter testing

6) Checking capillary or urine ketones if blood glucose values are greater than 14 mmol/L. The hospital will provide supplies for this.

7) Completing the Insulin Pump Therapy Patient Bedside Logbook (Form # 20189) daily.

8) Informing nursing staff if:
   a) you have any signs and symptoms of low blood glucose
   b) blood sugar less than 4mmol/L;
   c) blood sugar 14mmol/L or greater
   d) for pregnant women when the majority of blood sugar readings are over 7mmol/L
   e) you have a problem with your pump and/or if you called the pump company’s 24 hour “1-800 assistance line”; or
   f) you feel like you can no longer self-manage your pump.
Patient Agreement to Self-Manage Insulin Pump In-Hospital

9) Understanding that your insulin pump may be discontinued and a different insulin delivery provided for if any of the following occurs:
   a) Physician or Nurse Practitioner’s order
   b) you are not physically, emotionally or mentally capable of managing the insulin pump at the time
   c) undergoing a radiology procedure other than an ultrasound;
   d) having a procedure under a general anesthetic
   e) other reasons deemed necessary by your attending physician or most responsible health care provider where the use of the insulin pump is risky or non-effective
   f) you do not agree or adhere to the self-management terms above

☐ I have read what is expected of me to self-manage my diabetes using my insulin pump in hospital. I am satisfied with and understand the information I have been given, and I agree to fulfill the self-management responsibilities.

<table>
<thead>
<tr>
<th>Patient/Guardian (print)</th>
<th>Patient/Guardian (signature)</th>
<th>Date (yyyy-Mon-dd)</th>
</tr>
</thead>
</table>
10. **Insulin Pump Information Sheet**  
(AHS form # 20114)  
*To be completed by patient (guardian/caregiver if under age 18) and placed on the patient chart*

### Insulin Pump Information Sheet

1. This form must be completed by a Patient (Guardian/Caregiver if under 18) who has agreed, along with a physician, that they will be responsible for self-management of insulin pump while in hospital. Patient (Guardian/Caregiver if under 18) must provide pump, and pump supplies while in hospital.
2. Patient (Guardian/Caregiver if under 18) will provide pump information and pump settings, and return completed form to the nurse, who will place or file in chart.

<table>
<thead>
<tr>
<th>Pump Information</th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Manufacturer</strong></td>
<td>Model Number</td>
</tr>
<tr>
<td><strong>Insulin Type (check one)</strong></td>
<td><strong>Do you use a CGM?</strong></td>
</tr>
<tr>
<td>☐ lispro (Humalog*)</td>
<td>☐ Yes</td>
</tr>
<tr>
<td>☐ aspart (Novorapid*)</td>
<td>☐ No</td>
</tr>
<tr>
<td>☐ Other (specify)</td>
<td>☐ Low Glucose Suspended?</td>
</tr>
<tr>
<td></td>
<td>☐ On</td>
</tr>
<tr>
<td></td>
<td>☐ Off</td>
</tr>
<tr>
<td></td>
<td>☐ Not Applicable</td>
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<table>
<thead>
<tr>
<th>Typical Total Daily Dose of Insulin units/24 hours</th>
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<table>
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<tr>
<th>Pump Settings</th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Basal Rate(s) units/hr</strong></td>
<td><strong>Insulin:Carbohydrate Ratio (ICR)</strong></td>
</tr>
<tr>
<td>Time (hh:mm)</td>
<td>Rate</td>
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<thead>
<tr>
<th>Bolus Insulin (Not using ICR)</th>
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<tbody>
<tr>
<td>Units</td>
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<tr>
<td>☐ With Breakfast/Feed at Time (hh:mm)</td>
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<table>
<thead>
<tr>
<th>Patient/Guardian/Caregiver Name (print)</th>
<th>Patient/Guardian/Caregiver Signature</th>
<th>Date (yyyy-mm-dd)</th>
</tr>
</thead>
</table>
11. **In-Hospital Orders for Self-Management of Insulin Pump**

(AHS form # 20102)

*Completed by MD or other prescriber*

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**Guidelines for the Safe Management of Insulin Pump Therapy in Hospital**

*Diabetes Obesity Nutrition SCN December 22, 2016*

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**In Hospital Orders for Self Management of Insulin Pump**

Use this order set only if Attending Physician/Nurse Practitioner has determined that patient meets criteria, and Patient (Guardian if under age 18) agrees to the self management of insulin pump in hospital responsibilities.

1. Discontinue all previous insulin orders
2. Orders marked with ☑️ are active by default, unless crossed out and initialed by prescriber. Boxed orders (☐) require prescriber checkmark (☐) to be initialed

- ☑️ Patient/Guardian has read and accepted the terms of the Patient Agreement to Self-Manage Insulin Pump In-Hospital *(Form 20369)*.
- ☑️ Patient/Guardian to sign the Patient Agreement to Self-Manage Insulin Pump In-Hospital *(Form 20369)*. Completed form to be placed on chart.
- ☑️ Patient (Guardian/Caregiver if under age 18) to complete Insulin Pump Information Sheet *(Form 20114)*
- ☑️ Patient (Guardian/Caregiver if under age 18) to complete Insulin Pump Therapy Bedside Logbook daily *(Form 20189)*
- ☑️ Nurse to review and sign Insulin Pump Therapy Bedside Logbook *(Form 20189)* at the end of each shift. Completed form to be placed into chart daily at 0700.
- ☑️ Do not stop or suspend the insulin pump unless physician provides alternative regime of insulin. *(If pump stopped, basal insulin must be replaced within 2 hours to prevent Diabetic Ketoacidosis (DKA))*

**Bedside Blood Glucose Monitoring** *(Hospital meter)*
- ☑️ Before Meals and bedtime
- 2 hours after site change
- ☐ 0300 hours
- ☐ Every ___ hours
- ☐ Other (specify) _______________

**Hyperglycemia**
- ☑️ If blood glucose is over 14 mmol/L, patient to check ketones. If positive for ketones, patient to self administer correction insulin by syringe or pen, change infusion set and nurse to notify MD

**Hypoglycemia**
- ☑️ Do not remove or stop Insulin Pump Therapy without Physician Order
- ☑️ Treat according to Hypoglycemia protocol
- ☑️ Patient to change site every ___ day(s) *(usually every 2-3 days)*, starting Date *(yyyy-mon-dd)*

**Insulin Type** *(use in pump)*
- ☐ lispro *(Humalog®)*
- ☐ aspart *(Novorapid®)*
- ☐ Other (specify) _______________

**Pump Settings** *(Patient to manage pump according their specified settings; Refer to Insulin Pump Information Sheet *(Form 20114)* and Insulin Pump Therapy Bedside Logbook daily *(Form 20189)*

<table>
<thead>
<tr>
<th>Physician Name</th>
<th>Physician Signature</th>
<th>Date * (yyyy-mon-dd)</th>
<th>Time * (hh:mm)</th>
</tr>
</thead>
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*IPT terminology on back of paper-based order set*
12. **Insulin Pump Therapy Patient Bedside Logbook**  
(AHS form #20189)  
*To be completed by patient (guardian/caregiver if under age 18).*

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<thead>
<tr>
<th>Date (yyyy-mm-dd)</th>
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<td>Blood glucose (mmol/L)</td>
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<td>Ketones positive</td>
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<td>Carbohydrates (grams)</td>
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| Blood glucose (mmol/L) |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| Ketones positive |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| Carbohydrates (grams) |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| Meal Bolus & Correction dose (units) |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| Basal rate (units/hr) |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| Site/setting change |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| Pump suspended/removed |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| Pump reconnected |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |

**Comments**

**Signatures**

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13. Guidelines for Management of Insulin Pump Therapy Emergencies

Key Message: “If pump stopped, must replace basal insulin within 2 hours to prevent Diabetic Ketoacidosis (DKA)”

Potential insulin pump emergencies are managed in a similar manner to any other patient with type 1 diabetes

1) DIABETIC KETOACIDOSIS (DKA) can occur very quickly (2-4 hours) if insulin delivery is disrupted for any reason because:
   - The insulin pump only delivers rapid acting insulin (continuously to cover basal requirements and in bolus fashion to cover meals and correct for high blood sugars)
   - Patients on the insulin pump do not use intermediate or long acting insulin

   Pump patients feeling unwell require immediate assessment for DKA:
   - Typical symptoms of DKA include lethargy, nausea, vomiting, abdominal pain, intercurrent illness
   - Perform assessment of hydration status
   - Urgent lab testing for blood glucose, serum electrolytes, capillary blood gas and urine/serum ketones
   - If patient on an SGLT2 inhibitor (canagliflozin (Invokana), dapagliflozin (Forxiga), empagliflozin (Jardiance), DKA may be present even if glucose is within normal range
   - AHS employees-please see Diabetic Ketoacidosis (DKA), Adult, Emergency Department, on AHS intranet under Clinical Knowledge Topics

   Treatment of hyperglycemia/DKA:
   - If DKA is confirmed, treat as one would for any individual with Type 1 diabetes, including IV insulin
   - Do not rely on the insulin pump for insulin delivery.
   - Disconnect/suspend pump and remove insertion set
   - If severe hyperglycemia, but not in DKA, and there is any concern regarding the integrity of the pump system, administer insulin via another route (SC or IV)

2) SEVERE HYPOGLYCEMIA
   - Suspend or disconnect the pump until blood glucose readings are above 6 mmol/L
   - Once above 6 mmol/L, restart the insulin pump
   - The patient will quickly become insulin deficient if the pump is disconnected for >2 hours
   - Following a severe hypoglycemic episode, instruct patient to reduce both the basal and bolus doses of insulin by approximately 20% for several days

3) INFUSION SITE ABSCESS OR INFECTION
   Most are secondary to Staphylococcus aureus
   - Remove and discard infusion set and reservoir
   - Have patient insert new infusion set at a new site, prepped with an antiseptic wipe
   - Incise and drain abscess, send debrided material for culture and susceptibility testing
   - Treat with cloxacillin
   - In high resistance areas, use antibiotic with methicillin-resistant Staphylococcus aureus (MRSA) coverage (Refer to local antibiogram)
NOTE: If the patient on insulin pump therapy is treated for any of the above 3 issues in the Emergency Department and not admitted to hospital, they should be instructed to contact their Diabetes Insulin Pump Clinic or their Diabetes in Pregnancy Clinic (if applicable) for reassessment of the insulin regimen and further pump education. You are asked to consider sending a referral to an approved insulin pump clinic in your area to ensure that follow up occurs.

Current referral information to approved insulin pump clinics is available at: http://www.health.alberta.ca/services/insulin-pump-therapy-program.html

If assistance is required in managing a pump-related emergency, please consult endocrinology on call (if available) at your site, or the patient’s diabetes physician.


These guidelines are available online at: (http://guidelines.diabetes.ca/Browse/Chapter15)
14. **Algorithm for the Safe Use of Insulin Pump during Procedures and Surgery**

*Key Message:* “If pump stopped, must replace basal insulin within 2 hours to prevent Diabetic Ketoacidosis (DKA)”

![Algorithm Diagram]

- **Local Anesthesia Or Conscious Sedation** (duration of cognitive impairment < 2 hours)
  - Patient May Continue to Use Pump

- **Conscious sedation (duration of cognitive impairment >2 hours)**
  - Stop Insulin Pump and Switch to Appropriate Alternate Insulin Prescription (Basal-Bolus Regimen or IV Insulin)

- **General Anesthesia**
  - Short/Medium Duration
    - Stop Insulin Pump and Switch to IV Insulin
  - Long (major risk of hypotension and hemodynamic instability)
    - Stop Insulin Pump and Switch to IV Insulin
15. Guidelines for Managing Pump during Radiologic Procedures

**Key Message:** “If pump stopped, must replace basal insulin within 2 hours to prevent Diabetic Ketoacidosis (DKA)”

The insulin pump (including pods) *(see Section 4)* and/or the continuous glucose monitoring system (CGM: sensor and transmitter) should NOT be worn for procedures with expected exposure to electromagnetic field:

- Radiologic procedures (other than ultrasound)
- MRI *(NOTE: remove metal cannula for MRI – found on some pump insertion sets and CGM)*
- CT scan
- Nuclear Stress Test (just for the scan not the exercise component)
- PET scan
- Cardiac catheterization
- Electric shock for defibrillation

**If the procedure is < 1 hour:**
- Remove insulin pump* and CGMS and keep outside the procedure room in a safe and dry place with patient’s name and ID #.
- Once procedure complete, patient will reconnect pump and check blood sugar with administration of a correction dose for hyperglycemia

**If procedure 1-2 hours:**
- The patient should administer a bolus dose before disconnecting the insulin pump
- The bolus dose is a calculation of the basal dose which would have been administered over the next 1-2 hours
- EXAMPLE: Procedure is 2 hours long
  - Basal rate at that time is 0.8 units/hour
  - The patient will administer $0.8 \times 2 = 1.6$ units as a bolus
- Remove pump* and/or CGM and keep outside the procedure room in a safe and dry place with patient’s name and ID #.
- Once procedure complete, patient will reconnect pump and check blood sugar with administration of a correction dose for hyperglycemia

**If procedure > 2 hours:**
- The insulin pump should be discontinued* and either basal bolus sc insulin or IV insulin should be initiated
- See “Guidelines for switching from insulin pump to basal/bolus insulin” *(see Section 16)*

*If/when the pump is removed, the flow of insulin will continue and this moisture could damage the pump. Therefore, have patient suspend pump and once reconnected after the procedure, the pump must be unsuspended.*
16. Guidelines for Switching between Insulin Pump Therapy and Subcutaneous Insulin or IV insulin

Key Message: “If pump stopped, must replace basal insulin within 2 hours to prevent Diabetic Ketoacidosis (DKA)”

Switching from Insulin Pump to Subcutaneous (sc) Basal Bolus insulin

The calculations below will provide a safe transition between the insulin pump and subcutaneous basal/bolus insulin therapy. However, when transitioning between modes of insulin delivery, review of capillary glucose monitoring is required to assess the adequacy of the insulin doses provided and adjustments made based on these results.

If available at your site (for adults):
Use one of the following to enter orders for basal bolus insulin therapy:

- For non-electronic / paper based facilities:
  AHS Basal Bolus Insulin Therapy (BBIT) Adult Inpatient Order Set (form 19885)
- For Calgary Zone SCM:
  Basal Bolus Insulin Therapy Order Set

BASAL Dose Calculation
1) Take average of total daily doses (TDD) (available on pump)
2) Divide by 2 to get the Total Daily Basal dose
3) Administer glargine or determir as single dose once/day or in equally divided doses twice daily. Alternatively, Humulin N can be administered twice daily if there is a contraindication to glargine or determir
   EXAMPLE: TDD = 60 units
   a) 60 ÷ 2 = 30 Total basal dose
   b) 30 units once daily
    OR
    30 ÷ 2 = 15 units given twice daily (Breakfast and bedtime)
4) Discontinue pump 2 hours after the first dose of basal insulin is administered

BOLUS FOR MEALS Options
1) Patient may use their existing insulin:carbohydrate ratios (ICR)
   EXAMPLE: 1:10 means 1u of rapid insulin takes care of 10g of carbohydrate
   OR
2) If patient typically eating only 3 meals/day (no snacks), take half of usual total daily dose, divide by 3 and administer with meals
   EXAMPLE: TDD 60 units
   60 ÷ 2 = 30
   30 ÷ 3 = 10 units with each meal
   OR
3) If patient was typically eating 3 meals/day and between meal snacks, take half of usual total daily dose, divide by 4 and administer with meals
   EXAMPLE: TDD 60 units
   60 ÷ 2 = 30
   30 ÷ 4 = 7.5 (round to 7 or 8 units) with each meal
CORRECTION INSULIN Options

1) Patient may use their existing insulin sensitivity factor (ISF) OR
2) Create a correction sliding scale based on their ISF
   EXAMPLE:
   a) ISF of 2 means 1 unit of rapid insulin will drop sugars by 2 mmol/L
   b) May create a correction sliding scale that administers 1 extra unit of rapid insulin for every 2 mmol/L above 8 mmol/L

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3) If available at your site (for adults); use:
   • For paper based facilities: AHS Basal Bolus Insulin Therapy (BBIT) Adult Inpatient Order Set (form 19885)
   • For Calgary Zone SCM: Basal Bolus Insulin Therapy Order Set to choose a scale for “Correction for Hyperglycemia” based on total daily dose (TTD) of insulin

Switching from Subcutaneous Basal/Bolus Insulin Back to Insulin Pump

1) If patient is capable and willing to self-manage, restart pump on original settings if appropriate or consult Diabetes Consult Service or Endocrinology to assist with rate adjustments
2) Discontinue all previous insulin orders.
3) Restart pump at the time of the next scheduled dose of basal insulin to prevent insulin stacking. Instruct patient to consider a reduced temporary basal rate for the first 12 hours if they have been on twice daily basal insulin.
4) Check glucose 2 hours after pump restart to ensure site is working well

Switching from IV Insulin Back to Insulin Pump

1) If patient is capable and willing to self-manage, restart pump on original settings if appropriate or consult Diabetes Consult Service or Endocrinology to assist with rate adjustments.
2) Continue IV insulin infusion for the first 2 hours of the pump restart to allow the formation of a subcutaneous depot of insulin
3) Patients in Diabetic Ketoacidosis (DKA) may be transitioned back to the pump after resolution of the diabetic ketoacidosis
4) Check glucose 4 hours after pump restart (2 hours after IV insulin stopped) to ensure site is working well
17. Guidelines for Managing the Insulin Pump in a Pregnant Woman

Key Message: “If pump stopped, must replace basal insulin within 2 hours to prevent Diabetic Ketoacidosis (DKA)”

Women with Type 1 diabetes may be managed with the insulin pump during their pregnancy. They are followed closely as outpatients by a diabetes specialty team, including a diabetes specialist, nurse and dietician, most often in a Diabetes in Pregnancy Clinic setting.

When a pregnant patient with diabetes on the insulin pump is admitted to hospital, it is imperative to consult the endocrinology consult service or diabetes specialty consult service (whoever manages diabetes in pregnancy in your hospital). Some hospitals may have specific pre-admission orders in place for the patient as well.

If patient is admitted antepartum:
1) Patient may be able to self-manage with the insulin pump, assuming she meets criteria for self-management (*see Assessment of Capability to Self-Manage)
2) Diabetic ketoacidosis (DKA) is associated with significant morbidity and mortality in the mother, and up to a 50% risk of mortality in the fetus. Therefore:
   a) Hyperglycemia with sugars >14 mmol/L should prompt ketone testing (urine or serum).
   b) If positive for ketones and/or if she exhibits typical DKA symptoms, she should be tested for DKA (Perform assessment of hydration status and urgent lab testing for blood glucose, serum electrolytes, capillary blood gas and urine/serum ketones)
   c) If DKA confirmed, treat as one would treat anyone with Type 1 diabetes, including intravenous (IV) insulin.

If patient admitted for Labour and Delivery:
1) Women may be able to continue the pump during labour and delivery with adequate planning and preparation and close follow-up during labour and delivery by their diabetes care team. This practice may vary by Zone, Hospital or care provider.
2) A well thought out and clear plan should be in place prior to admission.
3) If a plan is not in place, the patient should be switched to intravenous insulin, aiming for sugars between 4.0-7.0 mmol/L.
4) At any point during labour and delivery, if the woman is not able to self-manage (see Section 6) then the patient should be switched to intravenous insulin, aiming for sugars between 4.0-7.0 mmol/L.
5) After delivery, women’s insulin requirements drop. She should reduce her insulin doses to the post-partum pre-specified settings suggested by her diabetes care team immediately. If a plan is not in place; please contact the diabetes care team immediately.

Post-partum:
1) If the patient was able to remain on the insulin pump through labour and delivery, she should reduce her insulin doses to the post-partum pre-specified settings suggested by her diabetes care team. If a plan is not in place; please contact the diabetes care team immediately.
2) If she was on IV insulin, the insulin pump may be resumed using the post-partum insulin dose settings pre-specified by her diabetes care team. Stop the IV insulin 2 hours after the pump is resumed.
3) Be aware that the dose of insulin will change based on the patient’s diet and whether or not the patient is breastfeeding. Therefore, frequent monitoring of blood sugars is indicated (4 to 7 times/day).

4) Follow-up after discharge should be with the patient’s diabetes in pregnancy care team.
Appendix 1: Safer Practice Notice

Safer Practice Notice

Status
Active
Updated
Resolved

Zone Application
Provincial
North
Edmonton
Central
Calgary
South

Safe Insulin Pump Therapy in Acute Care

Issue
Insulin pump therapy is becoming more common in the care of patients with type 1 diabetes. Insulin pumps deliver continuous subcutaneous rapid acting insulin. Patients do not receive intermediate or long acting insulin.

Severe hyperglycemia and/or Diabetic Ketoacidosis (DKA) can result when Insulin Pump Therapy is stopped for as little as 2.4 hours and insulin is not replaced - even if glucose values are normal or low when pump is discontinued.

Action
- If insulin pump is stopped, basal insulin must be replaced within 2 hours to prevent Diabetic Ketoacidosis (DKA)
- If DKA develops, it must be treated with IV insulin. The pump should not be used to deliver insulin. Follow Emergency department DKA protocol.
- If severe hyperglycemia, but not in DKA; and there is concern regarding the integrity of the pump system, discontinue the pump and administer insulin via another route (sc or IV)
- For severe hypoglycemia; suspend or disconnect pump. Once blood glucose above 6.0 mmol/L, insulin must be replaced (pump, sc, or IV)
- The insulin pump should be removed for all radiologic procedures, except ultrasound, due to exposure to electromagnetic fields. The pump should be discontinued, and sc or IV insulin treatment should be initiated before procedure, for any procedure longer than 2 hours, or requiring general anaesthetic.
- If unfamiliar with insulin pump therapy, contact Endocrinology on-call, Certified Diabetes Educator, or your local Diabetes expert

13 August 2015
For Information of:
- Emergency Departments
- Acute Care settings
- Diagnostic Imaging
- Physicians
- Nurses
- Pharmacists

Contact
Glenda Moore, Manager
Diabetes Obesity Nutrition (DON)
Strategic Clinical Network (SCN)
1-403-943-1847
Glenda.moore@albertahealthservices.ca

Resources
Provincial resources (policy, guidelines and order set) are being developed as part of the DON SCN Diabetes Inpatient Management initiative. Current resources available:
- Calgary Zone insulin pump website: http://vuw.org.ca/gdm/pumps
- Video: Safety & Insulin Pumps in Emergency and Hospital Situations courtesy of Diabetes Care Program of Nova Scotia: http://vquad.be/SC3d5JtMkJM

This material is intended for use only by Alberta Health Services staff/Medical and Midaffary staff. External readers should review the information in the context of their own environment to determine applicability. Alberta Health Services expressly disclaims all liability for the use of these materials, and for any errors, actions, demands or suits arising from such use. Further information about this and other Patient Safety Alerts and Safer Practice Notices can be found at http://www.albertahealthservices.ca/patientsafety
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We would like to acknowledge the following individuals for their contributions to the creation of these resources / tools for the safe management of Insulin Pump Therapy in acute care:

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Appendix 3: References


Appendix 4: Provincial In-Patient Diabetes Management Initiative Pictogram