Purpose

To support assessment, early recognition, and prompt intervention for adult patients experiencing a hyperglycemic event.

Applicability

This procedure applies to Covenant Health acute care inpatient areas and may also be used in non-acute settings (see “Responsibility” category).

Principles

Blood glucose targets are five to ten millimoles per litre for the majority of non-critically ill adult inpatients, as long as these targets can be safely achieved.

Diabetic Ketoacidosis (DKA) is a diabetic emergency. It is caused by a deficiency of insulin and elevated levels of counter regulatory hormones. This ensuing hyperglycemia results in a combination of osmotic diuresis, electrolyte abnormalities and ketone production/acidosis that can lead to significant morbidity and mortality.

It is important to avoid overtreatment of hypoglycemia since this can result in rebound hyperglycemia.

Responsibility

Site/unit managers are responsible for determining whether this policy and procedure in whole or in part is appropriate to their site and for communicating that out to staff.

Health care professionals shall adhere to the requirements identified in Covenant Health policy #VII-B-460, Glycemic Management, and the requirements identified in this procedure when caring for patients with hyperglycemia.

Care and management of patients shall be provided by health care professionals within their scope of practice.

Point of care testing (POCT) with glucose meters shall be performed by health care providers who have received appropriate glucose meter clinical education and training, and have maintained the ongoing competency requirements.

Authorized prescribers shall follow a basal bolus insulin regime for patients and avoid sliding scale.

Procedure

1. An order is not required to implement this procedure, provided that a health care professional has determined that the patient meets the specific circumstances and implementation criteria outlined within the procedure.
1.1 Holding of insulin requires an order from the most responsible health practitioner.

Note: Holding basal or bolus insulin after a hypoglycemic event commonly results in significant hyperglycemia 3-4 hours later.

2. Identification of Hyperglycemia

2.1 Hyperglycemia may be due to:

a) insufficient insulin;

b) insulin omission; and/or

c) recent ingestion of carbohydrate.

2.2 Symptoms of significant hyperglycemia include: thirst, fatigue, dizziness, tiredness, polyuria, nausea, vomiting, blurred vision, lethargy, sweet smelling breath, and hyperventilation.

2.3 Hyperglycemia in acute care settings may be identified as:

a) Mildly out of range, or mild hyperglycemia when blood glucose level is between 10 to 14 mmol/L.

b) Moderate hyperglycemia when blood glucose level is between 14.1 to 18 mmol/L.

c) Severe hyperglycemia when blood glucose level is greater than 18 mmol/L.

3. Treatment of Hyperglycemia

3.1 Provide insulin or oral anti-hyperglycemic medications as ordered. Refer to Appendix A, Adult Hyperglycemic Algorithm.

3.2 If blood glucose is greater than 18 mmol/L:

a) Do not promote activity/exercise (i.e., physiotherapy).

b) Review anti-hyperglycemic medication administration (i.e. regular insulin dosing schedule, timing of last insulin administration, held or missed insulin or anti-hyperglycemic medication. etc.)

c) Review last carbohydrate administration/ingestion.

d) Contact the most responsible health practitioner for further orders. The most responsible health practitioner should consider physical and/or lab assessment to rule out DKA in patients with Type 1 diabetes.
3.3 If patient has Type 1 diabetes and blood glucose is greater than 18 mmol/L; stat ketone testing is recommended (to be ordered by the most responsible health practitioner). Available method of ketone varies across acute care site so will be site dependent.

3.4 If patient is on Insulin Pump Therapy (IPT) and blood glucose is greater than 14 mmol/L, patient should be supported to test for ketones as per AHS Guidelines for Safe Management of Insulin Pump Therapy in Hospital resource. If patient does not have their own testing supplies, stat ketone testing should be ordered.

3.5 If patient on sodium-glucose co-transporter 2 (SGLT2) inhibitors and blood glucose is greater than 14 mmol/L, or they display symptoms of DKA, stat ketone testing is recommended. SGLT2 inhibitor medications include canagliflozin (Invokana), dapagliflozin (Forxiga) and empagliflozin (Jardiance).

a) If ketones are positive; contact the most responsible health practitioner immediately. Do not promote activity/exercise (eg. physiotherapy).

3.6 Retest blood glucose according to direction from the most responsible health practitioner.

3.7 If unable to decrease blood glucose levels below 18 mmol/L with additional prescribed treatment, patients with Type 1 diabetes shall be assessed for DKA. Assessment includes but is not limited to:

a) symptoms of DKA including: polyuria, thirst, nausea/vomiting, abdominal pain, weakness, mental status change, weight loss, and coma;

b) vital signs;

c) medication review (i.e. regular insulin dosing schedule, timing of last insulin administration, held or missed insulin, etc.);

d) last carbohydrate administration/ingestion; and

e) previous history/episodes of DKA.

3.8 If DKA is suspected, notify the most responsible health practitioner. Implement site and/or unit DKA protocol in consultation with the most responsible health practitioner.

4. Ongoing Patient Monitoring and Education

4.1 Once the patient’s glycemic status has stabilized, recommence routine blood glucose monitoring and/or increased monitoring as ordered.
4.2 Review the recent hyperglycemic event(s) and look at efforts to prevent a recurrence.
   a) Review patient understanding of the hyperglycemic event, and provide education/training as required.
   b) Review to see if hyperglycemia followed a hypoglycemic episode.

Note: holding of basal insulin and/or oral antihyperglycemic medication following a hypoglycemic episode may result in subsequent hyperglycemia. However, adjustments to insulin regime may be required.

4.3 Referral to a Certified Diabetes Educator (CDE) or diabetes specialist, (when available), if required.

5. Documentation of Hyperglycemic Event

5.1 The following information shall be documented in the patient's health record:
   a) all capillary blood glucose test results;
   b) associated patient symptoms observed/reported;
   c) all treatment provided, including interventions and medications administered to control/manage the patient's hyperglycemic event;
   d) notification of the other members of the health care team;
   e) assessment, observation or report of possible contributing factors (i.e., missed or held insulin or diabetes medication, excess carbohydrate intake, initiation of steroid therapy, infection, etc.); and
   f) patient/family teaching.

Definitions

*Adult* means a person aged 18 years and older.

*Health care professional* means an individual who is a member of a regulated health discipline, as defined by the *Health Disciplines Act* [Alberta] or the *Health Professions Act* [Alberta], and who practices within scope and role.

*Health record* means Covenant Health's legal record of the patient's diagnostic, treatment and care information.

*Most responsible health practitioner* means the health practitioner who has responsibility and accountability for the specific treatment/procedure(s) provided to a patient and who is authorized by Covenant Health to perform the duties required to fulfill the delivery of such a treatment/procedure(s), within the scope of his/her practice.
**Order** means a direction given by an authorized prescriber to carry out specific activity (ies) as part of the diagnostic and/or therapeutic care and treatment, to the benefit of a patient. An order may be written (including handwritten and or electronic), verbal, by telephone or facsimile.

### Related Documents
Covenant Health corporate policies, available @ [http://www.compassionnet.ca/Page2099.aspx](http://www.compassionnet.ca/Page2099.aspx)
- Glycemic Management Policy #VII-B-460
- Treatment of Hypoglycemia Procedure (& Algorithm), #VII-B-470

Basil Bolus Insulin Therapy – Learning Modules, etc. @ [http://www.bbit.ca/](http://www.bbit.ca/)

### References
- Canadian Diabetes Association 2013 Clinical Practice Guidelines
- CARNA Medication Guidelines 2015

### Revision Date(s)
N/A
**Hyperglycemia: Management and Treatment**

**– Adult Patients –**

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## Adult Hyperglycemia Algorithm

### Step 1: Recognize

**Blood Glucose is greater than 18.0 mmol/L**

### Step 2: Treat

- Provide insulin or other antihyperglycemic medications as ordered
- Suspend exercise or physical activity
- Review chart and confer with patient for possible causes (insulin or other antihyperglycemic meds held, dietary intake)
- Contact most responsible health practitioner (MRHP) for orders
- Retest blood sugar

**Exception**

*Intervention required earlier* (a blood glucose greater than 14.0 mmol/L) for:
- Patients on Insulin Pump Therapy
- Patients on SGLT2 inhibitors

**Stat ketone testing** is recommended for patients:
- With Type 1 diabetes
- On SGLT2 inhibitors e.g. canagliflozin (Invokana), dapagliflozin (Farxiga) and empagliflozin (Jardiance)

IF Ketones are positive:
- Contact MRHP for further orders
- Monitor for signs and symptoms of DKA

If DKA is suspected, notify the most responsible health practitioner. Implement site and/or unit DKA protocol in consultation with the MRHP.

### Step 3: Follow-up

- Once patient’s glycemic status stabilized:
  - Commence routine blood glucose testing, or as ordered
  - Review event, and develop plan to mitigate reoccurrence
  - Review to see if hyperglycemia followed a hypoglycemic episode.
  - Review patient understanding. Provide education if required.
  - Reassessment of diabetes medication by MRHP
  - Referral to Certified Diabetic Educator, or diabetes specialist, if required
  - Documentation of hyperglycemic event

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Adapted from AHIS 29° Sept 2017