



TITLE

**TREATMENT OF HYPERGLYCEMIA - ADULT**

SCOPE

Provincial: Acute Care

DOCUMENT #

HCS-206-02

APPROVAL AUTHORITY

Clinical Operations Executive Committee

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SPONSOR

Diabetes, Obesity & Nutrition Strategic Clinical Network

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Glycemic Management – Adult Policy (#HCS-206)

SCHEDULED REVIEW DATE

July 12, 2024

**NOTE:** The first appearance of terms in bold in the body of this document (except titles) are defined terms – please refer to the Definitions section.

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## OBJECTIVES

- To support assessment, early recognition and intervention for adult **patients** experiencing a hyperglycemic event, presenting to or admitted to an Alberta Health Services (AHS) Acute Care setting, including Intensive Care Units, Emergency Departments, Urgent Care Centres, Day Wards, and Addiction and Mental Health Inpatient Units.

## APPLICABILITY

Compliance with this document is required by all Alberta Health Services employees, members of the medical and midwifery staffs, students, volunteers, and other persons acting on behalf of Alberta Health Services (including contracted service providers as necessary).

## ELEMENTS

### 1. Points of Emphasis

- 1.1 This Procedure may be used in non-Acute Care settings. Site or Unit **Managers** are responsible for determining whether this Procedure in whole or in part is appropriate for their patient care setting and communicating relevant information out to **AHS representatives**.
- 1.2 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 this Procedure.
- 1.3 Blood glucose targets are 5.0 – 10.0 millimoles per litre (mmol/L) for the majority of non-critically ill adult inpatients, as long as these targets can be safely

achieved (refer to the AHS *Glycemic Management - Adult* Policy for details on patient care where these targets do not apply).

- 1.4 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.
- 1.5 Some patients should not be sent off the unit, especially for physical activity. These include:
  - a) patients with type 1 diabetes when their blood glucose is greater than 18.0 mmol/L and positive ketones;
  - b) patients on a sodium-glucose co-transporter 2 (SGLT2) inhibitor and positive ketones, regardless of blood glucose value; and
  - c) patients on insulin pump therapy (IPT) when blood glucose is greater than 14.0 mmol/L and positive ketones.
- 1.6 Holding of insulin requires an order from the **most responsible health practitioner (MRHP)**.
- 1.7 Holding basal or bolus insulin after a hypoglycemic event commonly results in significant hyperglycemia three (3) – four (4) hours later.
- 1.8 Timing of insulin administration should be coordinated with meals and blood glucose testing in the following order:
  - a) blood glucose testing should be done within 30 minutes prior to meals; and
  - b) meal/bolus and correction insulin should be administered based on this test no more than 30 minutes prior to meals.
    - (i) Short-acting insulin should be given 30 minutes prior to a meal.
    - (ii) Rapid-acting insulin should be given just before a meal.
    - (iii) Meal/bolus insulin may be given immediately after the meal/feed in certain situations (e.g., gastroparesis or concern that the patient may not be able to ingest or retain the full meal).
- 1.9 Capillary blood is not recommended for blood glucose testing for patients with severely impaired peripheral circulation (e.g., hypovolemia, shock).

- 1.10 Blood glucose testing may be repeated and/or verified by laboratory serum testing at the health care professional's discretion if the **point-of-care testing (POCT)** blood glucose reading is:
- a) inconsistent with the patient's clinical status (e.g., the patient is not exhibiting signs and symptoms of hyperglycemia); or
  - b) suspected to be related to equipment failure.

## 2. Personnel

- 2.1 Care and management of hyperglycemic patients shall be provided by all health care professionals within their scope of practice.
- 2.2 Point-of-care testing (POCT) with an AHS blood glucose meter shall be performed by health care professionals who have received appropriate glucose meter clinical education and training, and have maintained the ongoing competency requirements.

## 3. Identification of Hyperglycemia

- 3.1 Hyperglycemia may be due to:
- a) insufficient insulin or anti-hyperglycemic medication;
  - b) omission of insulin or anti-hyperglycemic medication; and/or
  - c) recent ingestion of carbohydrate.
- 3.2 Symptoms of significant hyperglycemia or DKA include:
- a) thirst, fatigue, dizziness, tiredness, polyuria, nausea, vomiting, blurred vision, lethargy, sweet-smelling breath, and hyperventilation.
- 3.3 Hyperglycemia in Acute Care settings may be identified as:
- a) mildly out of range, or mild hyperglycemia when blood glucose level is between 10.0 – 14.0 mmol/L;
  - b) moderate hyperglycemia when blood glucose level is between 14.1 – 18.0 mmol/L; or
  - c) severe hyperglycemia when blood glucose level is greater than 18.0 mmol/L.

## 4. Treatment of Hyperglycemia

- 4.1 Provide insulin or other anti-hyperglycemic medications as ordered. Refer to Appendix A: *Adult Hyperglycemia Algorithm*.
- 4.2 If blood glucose is greater than 18.0 mmol/L:

- a) Review anti-hyperglycemic medication administration (e.g., regular insulin dosing schedule, timing of last insulin administration, held or missed insulin or anti-hyperglycemic medication).
  - b) Review last carbohydrate administration/ingestion.
  - c) Contact the MRHP for further orders. The MRHP should consider physical and/or lab assessment to rule out DKA in patients with type 1 diabetes.
  - d) If the patient has type 1 diabetes and blood glucose is greater than 18.0 mmol/L, stat ketone testing is recommended (to be ordered by the MRHP).

**Note:** Available method of ketone testing varies across Acute Care sites and may be site-dependent.
  - e) If the patient is on IPT and blood glucose is greater than 14.0 mmol/L, the patient should be supported to test for ketones.
    - (i) Refer to the AHS *Guidelines for the Safe Management of Insulin Pump Therapy in Hospital* for more information.
    - (ii) If the patient does not have their own testing supplies, stat ketone testing should be ordered by the MRHP.
  - f) If the patient is on SGLT2 inhibitors and blood glucose is greater than 14.0 mmol/L or they display symptoms of DKA regardless of glucose value, stat ketone testing is to be ordered by the MRHP.
    - (i) SGLT2 inhibitor medications include: canagliflozin (Invokana), dapagliflozin (Forxiga), empagliflozin (Jardiance), and ertugliflozin (Steglatro).
  - g) If ketones are positive, contact the MRHP immediately for further orders.
    - (i) Patient should not be sent off the unit; do not promote physical activity/exercise.
- 4.3 Re-test blood glucose according to direction from the MRHP.
- 4.4 If unable to decrease blood glucose levels below 18.0 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 (e.g., regular insulin dosing schedule, timing of last insulin administration, held or missed insulin);
  - d) last carbohydrate administration or ingestion;
  - e) previous history/episodes of DKA; and
  - f) review of clinical status (e.g., acute coronary syndrome, infection, addition of medications that can cause hyperglycemia).
- 4.5 If DKA is suspected, notify the MRHP. Implement site and/or unit DKA protocol in consultation with the MRHP.
- a) For more information, refer to the AHS Clinical Knowledge Topics:
    - (i) *Diabetic Ketoacidosis, Adult – Emergency Department (DKA, Diabetes, Hyperglycemia, Hyperglycemic Hyperosmolar State); and/or*
    - (ii) *Diabetic Ketoacidosis, Adult – Inpatient.*
- 5. Ongoing Patient Monitoring and Education**
- 5.1 Once the patient's glycemic status has stabilized, resume routine blood glucose monitoring and/or increased monitoring as ordered.
- 5.2 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.
    - (i) Holding of basal or bolus insulin and/or other anti-hyperglycemic medication following a hypoglycemic episode may result in subsequent hyperglycemia. However, adjustments to insulin regime may be required.
- 5.3 Refer patient for diabetes education and/or to a diabetes specialist, when available and appropriate.
- 6. Documentation of Hyperglycemic Event**
- 6.1 The following information shall be documented in the patient's **health record**:
- a) all blood glucose test results;
  - b) associated patient symptoms observed or reported;

- c) all treatment provided, including interventions and medications administered to control or 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); and
- f) patient and family teaching provided.

## DEFINITIONS

**AHS representative** means Alberta Health Services employees, members of the medical and midwifery staffs, students, volunteers, and other persons acting on behalf of Alberta Health Services (including contracted service providers as necessary).

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

**Health record** means the collection of all records documenting individually identifying health information in relation to a single person.

**Manager** means the individual(s) who has the delegated human resource authority for directly planning, monitoring, and supervising direct (employee) reports.

**Most responsible health practitioner (MRHP)** means the health practitioner who has responsibility and accountability for the specific treatment/procedure(s) provided to a patient and who is authorized by Alberta Health Services to perform the duties required to fulfill the delivery of such a treatment/procedure(s), within the scope of their practice.

**Order** means a direction given by a regulated health care professional 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.

**Patient** means an adult or child who receives or has requested health care or services from Alberta Health Services and its health care providers or individuals authorized to act on behalf of Alberta Health Services. This term is inclusive of residents, clients and outpatients.

**Point-of-care testing (POCT)** means any testing that typically occurs outside a designated laboratory environment, and is completed nearer to, or at the site of the patient/client. This includes all testing performed by non-laboratory personnel regardless of the location of the examination.

## REFERENCES

- Appendix A: *Adult Hyperglycemia Algorithm*
- Alberta Health Services Governance Documents:

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- *Glycemic Management - Adult Policy (#HCS-206)*
- *Point-of-Care Testing (POCT) Policy (#PS-90)*
- Alberta Health Services Resources
  - *Diabetic Ketoacidosis, Adult – Emergency Department (DKA, Diabetes, Hyperglycemia, Hyperglycemic Hyperosmolar State) Clinical Knowledge Topic*
  - *Diabetic Ketoacidosis, Adult – Inpatient Clinical Knowledge Topic*
  - *Guidelines for the Safe Management of Insulin Pump Therapy in Hospital*
  - *Provincial Parenteral Manual*
- Non-Alberta Health Services Documents:
  - *Clinical Practice Guidelines 2018 (Diabetes Canada)*
  - *Medication Guidelines 2020 (College and Association of Registered Nurses of Alberta [CARNA])*
  - *Medication Guidelines 2020 (College of Licensed Practical Nurses of Alberta [CLPNA])*

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APPENDIX A

Adult Hyperglycemia Algorithm

Step 1: Recognize

Blood Glucose is above 18.0 mmol/L

Step 2: Treat

Provide insulin or other anti-hyperglycemic medications as ordered

Review chart and confer with patient for possible causes (insulin or other anti-hyperglycemic meds held, dietary intake)

Contact most responsible health practitioner (MRHP) for orders

Re-test blood glucose according to direction from MRHP

If unable to decrease blood glucose below 18.0 mmol/L with additional treatment, patients with type 1 diabetes shall be assessed for DKA. Assessment includes but is not limited to:

- Symptoms of DKA including: polyuria, thirst, weight loss, nausea/vomiting, abdominal pain, weakness, mental status change, coma
- Vital signs
- Medication review (regular insulin dosing schedule, timing of last insulin administration, held or missed insulin, etc.)
- Last carbohydrate administration / ingestion
- Previous history / episodes of DKA
- Review clinical status (e.g., acute coronary syndrome, infection, etc.)

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

Exception  
**Intervention required earlier** (with a blood glucose above 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®), empagliflozin (Jardiance®), ertugliflozin (Steglatro®)*

IF ketones are positive;

- Contact MRHP for further orders
- Monitor for signs and symptoms of DKA
- Patient should refrain from exercise or physical activity

Step 3: Follow-up

Once patient's glycemic status stabilized:

- Commence routine blood glucose testing, or as ordered
- Review event, and look at efforts to prevent a recurrence
- 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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