**OBJECTIVE**

- To support assessment, early recognition and intervention for adult **patients** presenting to, or admitted to, an Alberta Health Services (AHS) Acute Care setting who are experiencing hyperglycemia.

**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) working within Acute Care settings.

**ELEMENTS**

1. **Points of Emphasis**

   1.1 For the purposes of this policy suite only, Acute Care setting(s) includes all AHS urban and rural hospitals (including the Emergency Department), psychiatric facilities, and Urgent Care facilities.

   1.2 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 people**.

   1.3 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.
1.4 Blood glucose targets are five (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 (please refer to Section 2 of the provincial AHS Glycemic Management - Adult Policy for details on patient care where these targets do not apply.)

1.5 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.

1.6 Some patients should not be sent off the unit, especially for physical activity, when their blood glucose is greater than 18.0 mmol/L. These include:
   a) patients with type one (1) diabetes and positive ketones; and
   b) patients on a sodium-glucose co-transporter 2 (SGLT2) inhibitor and positive ketones.

1.7 Holding of insulin requires an order from the most responsible health practitioner (MRHP).

1.8 Holding basal or bolus insulin after a hypoglycemic event commonly results in significant hyperglycemia three (3) – four (4) hours later.

1.9 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 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; and
      (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).

1.10 Capillary blood is not recommended for blood glucose testing for patients with severely impaired peripheral circulation (e.g., hypovolemia, shock).
1.11 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; 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 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.

3. Identification of Hyperglycemia

3.1 Hyperglycemia may be due to:

a) insufficient insulin;

b) insulin omission; and/or

c) recent ingestion of carbohydrate.

3.2 Symptoms of significant hyperglycemia or diabetic ketoacidosis (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.

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 Hyperglycemic Algorithm.

4.2 If blood glucose is greater than 18.0 mmol/L:
a) 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.).

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 one (1) diabetes.

d) If the patient has type one (1) diabetes and blood glucose is greater than 18.0 mmol/L; stat ketone testing is recommended (to be ordered by the MRHP). Available method of ketone testing varies across Acute Care sites and may be site dependent.

e) If the patient is on Insulin Pump Therapy (IPT) and blood glucose is greater than 14.0 mmol/L; the patient should be supported to test for ketones as per the AHS Guidelines for Safe Management of Insulin Pump Therapy in Hospital. If the patient does not have their own testing supplies, stat ketone testing should be ordered.

f) If patient on sodium-glucose co-transporter 2 (SGLT2) inhibitors and blood glucose is greater than 14.0 mmol/L or they display symptoms of DKA; stat ketone testing is recommended.

   (i) SGLT2 inhibitor medications include: canagliflozin (Invokana), dapagliflozin (Forxiga) and empagliflozin (Jardiance) and ertugliflozin (Steglatro).

g) If ketones are positive;

   (i) contact the MRHP immediately for further orders;
   - patient should not be sent off the unit;
   - do not promote physical activity/exercise.

4.3 Retest blood glucose according to direction from MRHP.

4.4 If unable to decrease blood glucose levels below 18.0 mmol/L with additional prescribed treatment, patients with type one (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 or ingestion;

e) previous history/episodes of DKA; and

f) review of clinical status (i.e., acute coronary syndrome, infection, addition of medications that can cause hyperglycemia, etc.).

4.5 If DKA is suspected notify the MRHP. Implement site and/or unit DKA protocol in consultation with the MRHP.

5. Ongoing Patient Monitoring and Education

5.1 Once the patient's glycemic status has stabilized, recommence 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 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 Referral to a Certified Diabetes Educator (CDE) or diabetes specialist (when available) if required.

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, etc.); and
DEFINITIONS

AHS People means Alberta Health Services employees, members of the medical and midwifery staffs, Students, Residents, Volunteers, and other persons acting on behalf of AHS (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 Disciplines Act or the Health Professions Act, and who practises within scope and role.

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.

REFERENCES

- Appendix A: Adult Hyperglycemia Algorithm
- Alberta Health Services Governance Documents:
  - Glycemic Management-Adult Policy (#HCS-206)
  - Point of care Testing (POCT) Policy (#PS-90)
- Alberta Health Services Resources:
  - Guidelines for Safe Management of Insulin Pump Therapy in Hospital
- Non-Alberta Health Services Documents:
  - Diabetes Canada 2018 Clinical Practice Guidelines
  - CARNA Medication Guidelines 2015
  - CLPNA Medication Guidelines 2018

VERSION HISTORY

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<tr>
<td>October 27, 2017</td>
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<tr>
<td>February 4, 2019</td>
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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 antihyperglycemic medications as ordered

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 glucose according to direction from 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 (Forxiga®)
  - empagliflozin (Jardiance®)
  - ertugriline (Steglataro®)

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**

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 (eg: 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.

**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