OBJECTIVES

• To support assessment, early recognition, and prompt intervention for pediatric patients experiencing a hyperglycemic event in Alberta Health Services (AHS) Acute Care settings, 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. Exclusions

1.1 This Procedure shall not be applied to:

a) patients equal to or less than five (5) days old and infants admitted to the Neonatal Intensive Care Unit (NICU). The health care professional should contact the neonate’s most responsible health practitioner (MRHP) for direction or follow Zone processes;

b) pediatric patients who have diabetes and are pregnant; and

c) patients with diabetic ketoacidosis (DKA) on continuous intravenous insulin infusion.
2. **Points of Emphasis**

2.1 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**.

2.2 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.

2.3 Blood glucose targets are 5.0 to 10.0 millimoles per litre (mmol/L) for the majority of non-critically ill inpatients, as long as these targets can be safely achieved (refer to the AHS **Glycemic Management - Pediatric Policy** for when these blood glucose targets do not apply).

2.4 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. Refer to the AHS **Diabetic Ketoacidosis, Pediatric – Emergency & Inpatient Clinical Knowledge Topic**.

2.5 Hyperglycemia may be the result of the overtreatment of hypoglycemia. It is important to avoid overtreatment of hypoglycemia.

2.6 An order from the MRHP is required for patients to leave the unit when:

   a) the patient’s blood glucose is greater than 14.0 mmol/L; and
   
   b) the patient tests positive for ketones.

2.7 Contact the MRHP prior to holding insulin or resuming held insulin.

   a) Hyperglycemia is a common result of holding insulin after a hypoglycemic event.

2.8 Blood glucose testing should 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.

3. **Personnel**

3.1 **POCT with blood glucose meters** shall be performed by health care professionals who have received appropriate blood glucose meter clinical education and training, and have maintained the ongoing competency requirements.
4. Identification of Hyperglycemia

4.1 Hyperglycemia may be due to:
   a) insufficient insulin;
   b) insulin omission; and/or
   c) recent ingestion of carbohydrate.

4.2 Symptoms of significant hyperglycemia or DKA may include:
   a) thirst, fatigue, dizziness, tiredness, polyuria, nausea, vomiting, blurred vision, lethargy, sweet-smelling breath, and hyperventilation.

5. Treatment of Hyperglycemia

5.1 When the patient’s blood glucose (with or without a known history of diabetes) is greater than 14.0 mmol/L, stat ketone testing is recommended (to be ordered by the MRHP) for:
   a) patients with diabetes (type 1 or type 2) displaying symptoms of DKA, and/or if unable to decrease the patient’s blood glucose; and/or
   b) patients using insulin pump therapy when blood glucose is greater than 14.0 mmol/L, and/or if unable to decrease the patient’s blood glucose.
      (i) For more information, refer to the AHS Guidelines for the Safe Management of Insulin Pump Therapy in Hospital.

5.2 When ketone results are positive, contact the MRHP immediately for further orders:
   a) the patient should not be sent off the unit;
   b) do not promote physical activity/exercise; and
   c) the MRHP shall consider physical and/or lab assessment to rule out DKA; refer to the Diabetic Ketoacidosis, Pediatric – Emergency & Inpatient Clinical Knowledge Topic for care and treatment guidance.

5.3 Review insulin administration (e.g., insulin dosing schedule, timing of last insulin administration, held or missed insulin).

5.4 If the patient’s blood glucose level is above 14.0 mmol/L and the ketone result is negative:
   a) review last carbohydrate administration/ingestion;
   b) administer insulin as ordered; and
c) re-test blood glucose according to direction from the MRHP.

5.5 On reassessment (re-testing results according to MRHP direction), if blood glucose levels consistently remain above 14.0 mmol/L, with additional administered treatment, patients with diabetes shall be monitored to prevent adverse events such as DKA. Assessment includes, but is not limited to:

a) vital signs;

b) medication review (e.g., regular insulin dosing schedule, timing of last insulin administration, held or missed insulin);

c) last carbohydrate administration or ingestion;

d) previous history/episodes of DKA; and

e) review of clinical status (e.g., infection, addition of medications that can cause hyperglycemia).

f) If DKA is suspected, notify the MRHP and refer to the AHS Diabetic Ketoacidosis, Pediatric – Emergency & Inpatient Clinical Knowledge Topic for care and treatment guidance. Refer to Section 2.4 above.

5.6 Refer to Appendix A: Pediatric Hyperglycemia Algorithm

6. **Ongoing Patient Monitoring and Education**

6.1 Once the patient's glycemic status has stabilized, restart routine blood glucose monitoring and/or increased monitoring as ordered.

6.2 Review the recent hyperglycemic event(s) and look at efforts to prevent a recurrence.

a) Review the patient and/or family understanding of the hyperglycemic event and provide education/training as required.

b) Review to see if hyperglycemia followed a hypoglycemic episode.

   (i) Holding of insulin following a hypoglycemic episode may result in subsequent hyperglycemia. However, adjustments to insulin regimen may be required.

7. **Patient Consultation and Referrals**

7.1 For patients newly diagnosed with diabetes:

a) consult and send referral to Pediatric Endocrinology or a Pediatrician; and

b) consult and send referral to a specialty diabetes multidisciplinary care team with pediatric expertise for ongoing education and management as available.
7.2 For patients with a known diagnosis of diabetes with other medical conditions:
   a) ensure patient and family are followed by a specialty diabetes multidisciplinary care team with pediatric expertise for ongoing diabetes care; and
   b) consider a referral to local providers for further assessment or other pediatric specialty care (e.g., pediatric mental health providers) as required.

8. Documentation of Hyperglycemic Event

8.1 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 (e.g., 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). Family means one or more individuals identified by the patient as an important support, and who the patient wishes to be included in any encounters with the health care system, including but not limited to, family members, legal guardians, friends, and informal caregivers.

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

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

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: Pediatric Hyperglycemia Algorithm
- Alberta Health Services Governance Documents:
  - Glycemic Management – Pediatric Policy (#HCS-283)
  - Point of Care Testing (POCT) Policy (#PS-90)
- Alberta Health Services Resources:
  - Diabetic Ketoacidosis, Pediatric – Emergency & Inpatient Clinical Knowledge Topic
  - Insulin Pump Therapy, Pediatric and Adult – Acute Care Clinical Knowledge Topic
  - Guidelines for the Safe Management of Insulin Pump Therapy in Hospital (Diabetes Obesity Nutrition Strategic Clinical Network)
- Non-Alberta Health Services Documents:
  - Clinical Practice Guidelines 2018 (Diabetes Canada)
  - Medication Management Standards 2020 (College and Association of Registered Nurses of Alberta [CARN])
  - Practice Guideline: Medication Management 2020 (College of Licensed Practical Nurses of Alberta [CLPNA])

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Pediatric Hyperglycemia Algorithm

**Step 1: Recognize**

- Blood Glucose is above 14.0 mmol/L

**Step 2: Treat**

- Check Stat ketones
- Review chart and confer with patient/family for possible causes (insulin held, dietary intake)
- Contact most responsible health practitioner (MRHP) for orders
- Provide insulin as ordered
- Retest blood glucose according to direction from MRHP

IF Ketones are positive and patient self managing with Insulin Pump Therapy:
- Correct BG via injection
- Change infusion site
- Notify MRHP
- Monitor for signs and symptoms of DKA
- Patient should refrain from strenuous exercise or physical activity

**Step 3: Follow-up**

- Patients with 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

IF DKA is suspected, notify the MRHP. Refer to the Diabetic Ketoacidosis, Pediatric – Emergency & Inpatient clinical knowledge topic for care and treatment guidance.