Hyperglycemia

Aliases

Diabetic ketoacidosis (DKA), hyperosmolar hyperglycemic state, hyperosmolar non-ketotic coma, diabetes

Patient Care Goals

1. Limit morbidity from hyperglycemia by:
    - Appropriate use of glucose monitoring.
    - Appropriate hydration for hyperglycemia.

Patient Presentation

Inclusion Criteria

1. Adult or pediatric patient with altered level of consciousness [see Altered Mental Status guideline]
2. Adult or pediatric patient with stroke symptoms (e.g. hemiparesis, dysarthria) [see Suspected Stroke/Transient Ischemic Attack guideline]
3. Adult or pediatric patient with seizure [see Seizures guideline]
4. Adult or pediatric patient with symptoms of hyperglycemia (e.g. polyuria, polydipsia, weakness, dizziness, abdominal pain, tachypnea)
5. Adult or pediatric patient with history of diabetes and other medical symptoms

Exclusion Criteria

Patient in cardiac arrest

Patient Management

Assessment

1. Monitor blood glucose level**.**
2. Conduct secondary survey pertinent to altered blood glucose level:
    a. Constitutional: assess for tachycardia, hypotension, and tachypnea.
    b. Eyes: assess for sunken eyes from dehydration.
    c. Nose /mouth/ears: assess for dry mucus membranes or tongue bite from seizure.
    d. Neurologic:
        i. Assess GCS and mental status.
        ii. Assess for focal neurologic deficit: motor and sensory.
3. Evaluate for possible concomitant sepsis and septic shock **[**see Shock guideline].
4. Obtain 12-lead ECG to assess for peaked T waves or other findings consistent with hyperkalemia.

Treatment and Interventions

1. If altered level of consciousness, stroke, or sepsis/septic shock, treat per Altered Mental Status, Suspected Stroke/Transient Ischemic Attack**,** or Shock guidelines accordingly.
2. If glucose greater than 250 mg/dL with symptoms of dehydration, vomiting, abdominal pain, or altered level of consciousness:
    a. Provide volume expansion with normal saline bolus ***[AEMT]***
        i. Adult: Normal saline 1 L bolus IV; reassess and rebolus 1L if indicated
        ii. Pediatric: Normal saline 10 mL/kg bolus IV, reassess, and repeat up to 40 mL/kg total
3. Reassess patient.
    a. Reassess vital signs, mental status, and signs of dehydration.
    b. If mental status changes, reassess blood glucose level and provide appropriate treatment if hypoglycemia has developed.
4. Insulin Infusions **[PARA-Interfacility]**
    a. Refer to **Medication Protocol**

    b. Primarily for treatment of Diabetic Ketoacidosis or hyperglycemic hyperosmolar non-ketotic acidosis
    c. Ensure patient is also receiving Potassium containing fluid to prevent hypokalemia
        i. Potassium Containing fluids per sending facility parameters
    d. Follow parameters from sending facility or refer to Medication Dosing Guidelines
    e. If **blood glucose less than 250mg/mL then start D5/0.45% NaCl or D5/0.9% NaCl at 150ml/hr** [**Pediatrics**: appropriate maintenance rate] or per sending facility parameters
        i. Refer to separate dosing adjustment parameters for blood sugars in this situation
5. Implement disposition.
    a. Transport to closest appropriate receiving facility.

Patient Safety Considerations

1. Overly aggressive administration of fluid in hyperglycemic patients may cause cerebral edema or dangerous hyponatremia.
    a. Closely monitor for signs of altered mental status, increased intracranial pressure, and immediately discontinue IV fluids and elevate head of bed if signs of increased ICP develop.
    b. Reassess and manage airway as needed.
2. Asymptomatic hyperglycemia poses no risk to the patient while inappropriately aggressive interventions to manage blood sugar can harm patients.

Notes and Educational Pearls Key Considerations

- New onset diabetic ketoacidosis in pediatric patients commonly presents with nausea, vomiting, abdominal pain, and/or urinary frequency.
- Consider causes for hyperglycemia by thinking about the 3 I's:
    - Insulin—this refers to any medication changes for insulin or oral medications including poor compliance or malfunctioning insulin pump.
    - Ischemia—this refers to hyperglycemia sometimes being an indication of physiologic stress in a patient and can be a clue to myocardial ischemia in particular.
    - Infection—underlying infection can cause derangements in glucose control.

Pertinent Assessment Findings

- Concomitant trauma
- Abdominal pain, "fruity breath," and rapid-deep respirations (Kussmaul's respiration) may be associated with diabetic ketoacidosis.

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

- 9914121—Medical-Hyperglycemia

Key Documentation Elements

- Document reassessment of vital signs and mental status after administration of IV fluids.
- Document glucose level (if in scope of practice) when indicated.

Performance Measures

- When in scope of practice, point of care blood glucose checked for all patients with symptoms of altered level of consciousness, seizure, stroke, or hyperglycemia
- When hyperglycemia documented, appropriate volume replacement given while avoiding overzealous repletion before insulin therapy at receiving center
- 12-lead ECG obtained

EMS Compass® Measure *(for additional information, see www.emscompass.org)*

- *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms

References

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