Managing Diabetes and Hyperglycemia in the Hospital Setting

Hyperglycemia (blood glucose greater than 140mg/dL [7.8 mmol/L]) is common in acutely ill patients with and without established diabetes and is strongly associated with poor hospital outcomes. For most inpatients, targeting a glucose level between 140 and 180 mg/dl (7.8 and 10.0 mmol/l) will prevent complications of hyperglycemia while minimizing the risk of inadvertent hypoglycemia. Insulin is the best medication to treat hyperglycemia, especially in the ICU setting.

Classification & Clinical Findings (American Diabetes Association, 2022)

- **Type 1 diabetes** – deficiency of insulin secretion due to autoimmune β-cell destruction that leads to absolute insulin deficiency; usually sudden onset of symptoms in children or adolescents.
    - Diagnosis is based on the classic 3 P's (polyuria, polyphagia, polydipsia) plus two of the following lab results gathered from the same blood sample:
        - A1C level of 6.5% or higher
        - Fasting plasma glucose (FPG) greater than 126 mg/dL
        - Random blood glucose level greater than 200 mg/dL
- **Type 2 diabetes** – progressive loss of β-cell insulin secretion often with concurrent insulin resistance; gradual onset in adults with risk factors such as obesity
    - Diagnosis is indicated by two of the following lab results gathered from the same sample:
        - A1C level of 6.5% or higher
        - Fasting plasma glucose (FPG) greater than 126 mg/dL
        - Random blood glucose level greater than 200 mg/dL
- **Gestational diabetes mellitus** (GDM) – diabetes in pregnancy, usually diagnosed in the second or third trimester when overt diabetes was not present prior to pregnancy; characterized by glucose intolerance related to insulin resistance
- **Prediabetes**
    - Glucose levels do not fall in diabetic range but are too high to be considered normal. Prediabetes is diagnosed by the presence of impaired fasting glucose (IFG), impaired glucose tolerance (IGT), and/or an A1C level of 5.7% to 6.4%.
- **Stress hyperglycemia** – a transient increase in blood glucose due to the stress of acute illness, which usually resolves when the patient recovers.

Recommendations for Care

General Recommendations (American Diabetes Association, 2024)

- Document type of diabetes (type 1 or type 2) or "no history of diabetes" in the medical record.
- Check A1C levels in all patients with diabetes or hyperglycemia admitted to the hospital if no result has been documented in the prior three months. An A1C value greater than or equal to 6.5% (48 mmol/L) on admission suggests that diabetes preceded hospitalization.
- Assess diabetes self-management knowledge on admission and provide diabetes self-

management education (DSME) as appropriate.

- Administer insulin using validated written or computerized protocols that allow for changes in insulin dosing based on glycemic fluctuations.
- Monitor glucose in non-diabetic patients with elevated admission glucose or with risk factors for hyperglycemia, including:
    - Receiving enteral or parental nutrition
    - Prescribed glucocorticoids, octreotide or immunosuppressive medications
- The preferred treatment for hospitalized noncritically ill patients with poor oral intake or taking nothing by mouth (NPO) is basal insulin or basal insulin with bolus correction. For those with adequate oral intake, basal, prandial, and correction insulin is preferred.
- For stable hospitalized patients with diabetes, it is advisable to continue using personal continuous glucose monitors (CGMs) and to utilize automated insulin delivery (AID) systems alongside CGMs, if clinically appropriate. Institutional protocols should be in place for confirmatory point-of-care glucose measurements and assessing hypoglycemia.
- A hypoglycemia management protocol is recommended.

Insulin

Follow your institution policies and written orders for insulin administration.

General guidelines (American Diabetes Association, 2022):

- Monitor glucose before meals and at bedtime per orders.
- If a patient is not eating, or is NPO, monitor glucose every 4 to 6 hours and treat per orders.
- Subcutaneous rapid- or short-acting insulin injections are recommended.
- Administer insulin for persistent hyperglycemia greater than or equal to 180 mg/dL (10.0 mmol/L) on 2 consecutive tests.
- Once insulin has been started, target glucose range to 140-180 mg/dL (7.8- 10.0 mmol/L).
    - While this range may be appropriate for most inpatients, individualize targets as needed.
    - Tighter glucose control 110-140 mg/dL (< 7.8 mmol/L) may be used for some patients (i.e., post-surgical patients) if it does not cause significant hypoglycemia.
    - Higher glucose levels may be acceptable in terminally ill patients, in patients with severe comorbidities, and in patient care settings where frequent monitoring is not possible.
- Use clinical judgment and ongoing assessment of the patient's clinical status, including changes in glucose levels and concomitant medications that may affect glucose levels (i.e., glucocorticoids).
- Important reminders:
    - Significant discrepancies among capillary, venous, and arterial plasma blood glucose samples may occur with low or high hemoglobin concentrations or hypoperfusion.
    - Point-of-care (POC) glucose results that do not correlate with the patient's clinical status should be confirmed with a conventional lab-tested glucose sample.
    - Prohibit sharing of finger-stick lancing devices, needles, and meters to reduce the risk of transmission of blood-borne disease. Insulin pens are for single patient use only.
        - Sole use of sliding scale insulin and premixed insulin regimens are NOT recommended in the hospital setting.

Insulin Dose

- If the patient was previously on insulin, the preadmission dose should be used as a starting point.
    - Typically based on weight and range from 0.4 to 1.0 unit/kg/day
- For non-critically ill patients with good nutritional intake, insulin therapy should include:
    - Basal insulin (long-acting dose): defined as the amount of insulin secreted throughout the day in someone without diabetes; helps control blood glucose between meals and during sleep
    - Bolus/nutritional insulin (meal-time): calculated based on carbohydrate (grams) intake
    - Correctional (supplemental) insulin: for hyperglycemia above the target as needed and prescribed
- For non-critically ill patients with poor oral intake or taking nothing by mouth (NPO), use basal insulin or basal plus bolus correctional insulin. Administer rapid-acting insulin immediately after the patient eats or calculate the carbohydrates consumed and cover accordingly.
- For patients with type 1 diabetes, avoid dosing insulin based on premeal glucose level alone as this does not account for basal insulin requirements or caloric intake and may lead to hypoglycemia, hyperglycemia, and diabetic ketoacidosis (DKA). Basal insulin dosing is based on body weight; patients with renal insufficiency should receive lower doses.
- For patients receiving enteral or parenteral feedings, please refer to the guidelines outlined by the American Diabetes Association (2022). Insulin degludec has been added as a basal insulin option for enteral/parenteral feedings.

Hyperglycemia & Hypoglycemia

Please refer to the Nursing Pocket Card Managing Acute Diabetic Complications.

Hyperglycemia (Lippincott Procedures, 2020)

- In hospitalized patients, hyperglycemia is defined as blood glucose greater than 140 mg/dL (7.8 mmol/L).
- Signs and symptoms include increased thirst, increased urination, weight loss, headache, decreased energy level and blurry vision.
- Causes (other than diabetes) include stress from infection, acute illness, or surgery.
- Treat with correctional insulin as needed and prescribed.

Hypoglycemia (Lippincott Procedures, 2020; ADA, 2022)

- Hypoglycemia in hospitalized patients is categorized by the following:
    - Level 1 hypoglycemia: glucose level 54-70 mg/dL (3.0-3.9 mmol/L)
    - Level 2 hypoglycemia: glucose level less than 54 mg/dL (3.0 mmol/L); requires immediate glucose correction.
    - Level 3 hypoglycemia: a clinical event with a change in mental and/or physical functioning that requires assistance from another person for recovery; requires immediate glucose correction.
- Early symptoms include shakiness, weakness, sweatiness, hunger, dizziness, light-headedness, palpitations, and anxiety.
- Central nervous system signs and symptoms include vision changes, gait disturbances, changes in

affect or behavior, confusion, paresthesia, slurred speech and sleepiness progressing to coma or seizure.

- Hypoglycemia in the hospital may be caused by:
  - Improper prescribing of other glucose-lowering medications
  - Inappropriate management of the first episode of hypoglycemia
  - Nutrition-insulin mismatch (i.e., unexpected interruption of nutrition, enteral or parenteral feedings or reduced oral intake)
  - Acute kidney injury
  - Sudden decrease in corticosteroid dose
  - Poor timing of short- or rapid-acting insulin related to meals
  - Decreased infusion of intravenous dextrose
  - Delayed or missed blood glucose checks
  - Inability of patient to report symptoms

Considerations for Special Settings (American Diabetes Association, 2024)

Critical Care

- Utilize a continuous intravenous (IV) insulin infusion for glucose 180 mg/dL (10.0 mmol/L) or higher.
  - Titrate infusion carefully to prevent hypoglycemia, as prescribed.
  - Monitor blood glucose every 30 minutes to 2 hours while on an IV insulin infusion, as prescribed.
  - Titrate the infusion rate based on glycemic fluctuations using a validated written or computerized protocol.
- When transitioning patients with type 1 or type 2 diabetes from intravenous insulin to subcutaneous, administer a dose of subcutaneous basal insulin 2 hours before the intravenous insulin is discontinued. The basal dose should be based on the infusion rate during the last 6 hours of stable glucose readings.
- Failure to overlap the IV and subcutaneous insulin may result in rapid hyperglycemia and risk of diabetic ketoacidosis (DKA) in patients with type 1 diabetes.

Perioperative Care

- Recommended target glucose is 80-180 mg/dL (4.4-10.0 mmol/L).
- Perform a preoperative risk assessment for patients at high risk for ischemic heart disease and those with autonomic neuropathy or renal failure.
- Hold metformin the day of surgery.
- Hold other oral hypoglycemic agents the morning of surgery and give half the NPH dose or 75-80% of the dose of long-acting analog or pump basal insulin.
- Monitor blood glucose every 4-6 hours while NPO and treat with short-acting insulin as needed.
- Reducing insulin the evening before surgery by 25% may achieve perioperative blood glucose levels in the target range with lower risk of hypoglycemia.
- In non-cardiac general surgery patients, basal insulin plus premeal regular or short-acting insulin (basal-bolus) coverage is associated with improved glycemic control and lower rates of

perioperative complications compared with sliding scale regimens.

Patient Self-Management (American Diabetes Association, 2022)

- Patients may self-manage their diabetes in the hospital if the patient has:
    - A history of successful self-management of diabetes at home
    - Demonstrated the cognitive and physical skills needed to self-administer insulin and performed self-monitoring of blood glucose
    - Adequate oral intake
    - Shown proficiency in carbohydrate estimation
    - Been utilizing multiple daily insulin injections or continuous subcutaneousinsulin infusion (CSII) pump therapy
    - Stable insulin requirements
    - An understanding of sick-day management
- If self-management is used, a hospital protocol is recommended requiring that thepatient, nursing staff, and provider agree that self-management is appropriate.

Continuous Subcutaneous Insulin Infusion (CSII)

Patients with continuous subcutaneous insulin infusion pumps may continue to self-manage their infusion if they are mentally and physically capable to do so.

- Confirm that the patient has the supplies required to safely manage the pump.
- Ensure a policy and procedure is in place to help guide inpatient CSII therapy.
- Document basal and bolus doses at least daily.
- If the pump is discontinued for procedures, diagnostic imaging or surgery, subcutaneous insulin should be prescribed.

Noninsulin Therapies

- Consider discontinuing saxagliptin and alogliptin in patients who develop heart failure.
- Sodium-glucose cotransporter 2 (SGLT2) inhibitors:
    - Avoid in patients with severe illness, ketonemia or ketonuria, and during prolonged fasting and surgical procedures
    - Not recommended for routine in-hospital use
    - Discontinue 3 days before scheduled surgery

Discharge Planning

Please refer to the Nursing Pocket Card Discharge Planning for Patients with Diabetes Mellitus.

References:

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