Managing Acute Diabetic Complications

Diabetes mellitus (DM) is a chronic disease that can have very serious acute and life-threatening complications. Use this reference guide to assist you in the management of patients experiencing hypoglycemic (low blood glucose) and hyperglycemic (high blood glucose) emergencies.

Hypoglycemia

Hypoglycemia is reduced plasma glucose to a level that may induce symptoms of altered mental status and/or sympathetic nervous system stimulation. The blood glucose level that defines hypoglycemia varies in each patient; a level less than 70 mg/dL (3.9 mmol) is considered hypoglycemia in patients with diabetes.

Levels of Hypoglycemia (American Diabetes Association, 2021)

- Level 1: glucose level 54-70 mg/dL (3.0-3.9 mmol/L)
- Level 2: glucose less than 54 mg/dL (3.0 mmol/L)
- Level 3: severe event characterized by altered mental status and/or physical status requiring assistance.

Symptoms of Hypoglycemia		
Mild	**Moderate**	**Severe**
Shakiness	Headache	Seizures
Weakness	Behavior changes	Unresponsiveness
Hunger	Blurred, impaired, double vision	
Dizziness	Irritation	
Lightheadedness	Confusion	
Palpitations	Difficulty talking	
Diaphoresis		
Anxiety		

Causes of hypoglycemia in patients with diabetes include:

- Too much insulin
- Delayed or insufficient food intake or a missed meal or snack
- Exercise without adequate adjustment in food or insulin

A hypoglycemia management protocol is recommended and should include:

- A standardized, nurse-initiated hypoglycemia treatment protocol to immediately address blood glucose levels less than 70 mg/dL (3.9 mmol/L)
- A plan to prevent and treat hypoglycemia for each patient
- Reassessment of the insulin treatment plan if blood glucose drops below 70 mg/dL (3.9 mmol/L)
- Tracking and documentation of each episode in the medical record

Management of Hypoglycemia	
Glucose level	**Treatment**

Less than or equal to 70 mg/dL (3.9 mmol/L)	"15-15 Rule"
	• Administer 15 gm rapidly digested carbohydrate.
	  ○ For patients that can tolerate oral intake:
	  ▪ 4 ounces (120 mL) juice or regular soda
	  ▪ Glucose gel (follow instructions)
	  ▪ Glucose tablets (follow instructions)
	  ○ For patients that are NPO or cannot tolerate oral intake:
	  ▪ 50 mg (25 g) dextrose 50% I.V. slowly into large vein, or glucagon injection I.M.
	• Position patient on right side to prevent aspiration from vomiting.
	• Recheck blood glucose 15 minutes after treatment.
	• If levels remain low, re-treat patient until levels have stabilized.
	• No meals until blood glucose has risen to an acceptable level.

Severe hypoglycemia (Less than 40 mg/dL [2.2 mmol/L])	• Administer 30 gm rapidly digested carbohydrate. • Follow algorithm above.

Hyperglycemia

Hyperglycemia is an abnormally high blood glucose level. In a hospitalized patient, hyperglycemia is a level greater than 140 mg/dL (7.8 mmol/L). Early signs include frequent urination, increased thirst, weight loss, blurred vision, fatigue, and headache. Stress from infection, acute illness, or surgery can also cause hyperglycemia (Lippincott Procedures, 2021).

Treatment (American Diabetes Association, 2021)

- Insulin therapy should be started to treat persistent hyperglycemia greater than or equal to 180 mg/dL (10.0 mmol/L).
- Once initiated, target glucose range of 140-180 mg/dL (7.8-10 mmol/L) is recommended for the majority of critically and non-critically ill patients.
- More stringent goals (less than 140 mg/dL) may be appropriate for selected patients if it does not result in severe hypoglycemia.

Hyperglycemic Emergencies

If hyperglycemia goes untreated, toxic acids (ketones) build up in the blood (ketoacidosis) and urine (ketonuria). Two hyperglycemic emergencies are diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic state (HHS).

Comparing DKA and HHS		
	DKA	**HHS**
Definition	Severe, uncontrolled diabetes characterized by hyperglycemia, ketoacidosis and ketonuria	Severe, uncontrolled diabetes characterized by hyperglycemia, hyperosmolarity and dehydration

Plasma glucose	Greater than 250 mg/dL; often in the 350 to 500 mg/dL (19.4 to 27.8 mmol/L) range	Greater than 600 mg/dL; frequently exceed 1000 mg/dL (56 mmol/L)
Arterial pH	Less than 7.30	Greater than 7.30
Serum bicarbonate	Less than 18	Greater than 18
Urine ketones	Positive	Small/None
Serum ketones	Positive	Small/None
Serum osmolality	Variable	Greater than 320 mOsm/kg
Anion gap	Greater than 12	Variable
Mental status	Drowsy, stupor/coma	Stupor/coma
BUN/Creatinine	Elevated	Elevated
Onset	Rapid (Less than 24 hours)	Slow, over days
Affects	Both type 1 and 2 DM, but occurs most often in type 1	Both type 1 and 2 DM, but occurs most often in type 2 and elderly
Precipitating factors	• Decreased or missed dose of insulin • Physiologic stress (infection, surgery) • Undiagnosed or untreated diabetes • Excess alcohol intake	• Illness • Medications that cause hyperglycemia • Dialysis
Signs & symptoms	• Kussmaul respirations (rapid, shallow breathing) • "Fruity", acetone breath • Malaise, weakness, fatigue • Nausea, vomiting, abdominal pain • Cardiac arrhythmias, tachycardia • Hypotension • Mild disorientation, confusion	• Similar signs and symptoms as DKA • Dehydration, extreme thirst • Tachycardia • Hypotension • Mental status changes, lethargy • Fever • Loss of vision • Hallucinations
Treatment, as ordered	• Correct fluid deficit per prescriber orders based on degree of hypovolemia and serum Na^+ • Replace electrolytes, particularly potassium (K^+) • Reverse acidosis and ketosis (sodium bicarbonate IV for pH less than 6.9) • Administer insulin to reduce	• Correct fluid deficit per prescriber orders based on degree of hypovolemia and serum Na^+ • Replace electrolytes (K^+) based on adequate renal function • Administer insulin to reduce glucose level to 250-300 mg/dL (0.1 units/kg bolus followed by continuous IV infusion @ 0.1 units/kg/hour)

	glucose level to 150-200 mg/dL • Identify underlying cause	• Identify underlying cause
Signs of resolution	• Blood glucose level less than 200 mg/dL • Presence of two of the following: ○ Serum bicarbonate level 15 mEq/L or higher ○ pH greater than 7.3 ○ Anion gap 12 mEq/L or lower	• Osmolality is normal. • When mental status is back to baseline, patient may start clear liquid diet and transition to subcutaneous insulin.
Potential complications of treatment	• Fluid overload due to aggressive fluid replacement • Hypokalemia due to inadequate potassium replacement, or administration of bicarbonate • Hypoglycemia due to aggressive insulin treatment • Cerebral edema due to excessive hydration and rapid intracellular fluid shifts	
Nursing considerations	• Monitor hemodynamics, intake/output, serum osmolality, BUN, and creatinine. • Assess cardiac, renal, and mental status. • Monitor blood glucose every hour if on IV insulin infusion. • Monitor electrolytes (Na^+, K^+, Mg^+, PO_4), BUN, creatinine every 2-4 hours until stable, per policy. • If hypokalemic, delay insulin treatment until serum K^+ is greater than 3.3 mEq/L. • Monitor arterial blood gas (ABG) to determine if acidosis is resolving. • IV insulin should continue for 2 to 4 hours after the first dose of subcutaneous insulin administration to avoid hyperglycemia.	

References:

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