Diabetes Mellitus: Types, Symptoms and Treatment

Diabetes mellitus is a group of metabolic disorders characterized by chronic hyperglycemia due to impaired insulin secretion, insulin action, or both. It results in disturbances in carbohydrate, fat, and protein metabolism.

Classification of Diabetes Mellitus

1. Type 1 Diabetes Mellitus (T1DM)

- **Etiology:** Autoimmune destruction of pancreatic ?-cells (Type 1A), or idiopathic (Type 1B).
- **Onset:** Common in children and young adults.
- **Features:** Absolute insulin deficiency, rapid onset, ketosis-prone.
- **Management:** Lifelong insulin therapy is essential.

2. Type 2 Diabetes Mellitus (T2DM)

- **Etiology:** Insulin resistance and relative insulin deficiency.
- **Onset:** Usually after age 40 but increasingly in younger age groups due to obesity.
- **Features:** Often asymptomatic initially; associated with obesity, hypertension, dyslipidemia (metabolic syndrome).
- **Management:** Lifestyle modification + oral hypoglycemics ± insulin.

3. Prediabetes

- **Definition:** Intermediate hyperglycemia (impaired fasting glucose or impaired glucose tolerance).
- **Risk:** High risk of progression to T2DM.
- **Management:** Lifestyle changes, weight reduction, metformin in select patients.

4. Gestational Diabetes Mellitus (GDM)

- **Definition:** Glucose intolerance first recognized during pregnancy.
- **Risks:** Fetal macrosomia, maternal T2DM post-partum.
- **Management:** Dietary control ± insulin.

Clinical Presentation

- **Classic symptoms:**
  - Polyuria
  - Polydipsia
  - Polyphagia
  - Unexplained weight loss (especially in T1DM)
  - Fatigue or weakness
- **Chronic complications may dominate:**

- **Microvascular:** Retinopathy, nephropathy, neuropathy
- **Macrovascular:** Coronary artery disease, stroke, peripheral arterial disease

Diagnostic Criteria (ADA, WHO)

- **Fasting Plasma Glucose (FPG):** ? 7.0 mmol/L (126 mg/dL)
- **2-hour OGTT:** ? 11.1 mmol/L (200 mg/dL)
- **Random Plasma Glucose:** ? 11.1 mmol/L (200 mg/dL) in symptomatic patient
- **HbA1c:** ? 6.5% (48 mmol/mol)

Note: Confirm diagnosis with repeat testing unless symptomatic with classic hyperglycemia.

Initial Evaluation

- **Laboratory Tests:**
  - Fasting glucose, HbA1c
  - Urinalysis: glucose, ketones, protein
  - Lipid profile, renal function tests
  - Blood pressure, BMI
  - ECG (for cardiovascular risk)

General Management Goals

1. Relieve symptoms (polyuria, fatigue).
2. Achieve glycemic control.
3. Prevent acute and long-term complications.
4. Patient education and empowerment.

Nutritional Therapy

- **Individualized plan** by a registered dietitian or trained provider.
- **Type 1 DM:** Caloric intake ~35 kcal/kg/day to regain and maintain weight.
- **Type 2 DM:** Caloric restriction ~15–20 kcal/kg/day in overweight/obese patients.

Macronutrient Composition:

- Carbohydrates: 45–60% (prefer complex, low GI foods)
- Protein: 15–20%
- Fat: <30% (emphasize unsaturated fats)
- Fiber: 20–30g/day from legumes, whole grains
- Avoid sugar-sweetened beverages; use artificial sweeteners (e.g., aspartame, saccharin)
- Consistent meal timing to match insulin or medication peak actions

Exercise

- At least **150 minutes/week** of moderate-intensity aerobic activity
- Resistance training 2–3 times/week

- Improves insulin sensitivity and glycemic control

Pharmacologic Management

In type 2 diabetes, oral hypoglycemics are commonly used. Metformin is the first-line agent unless contraindicated, such as in patients with significant renal impairment. Sulfonylureas such as glibenclamide or glimepiride stimulate insulin secretion but can cause hypoglycemia. Thiazolidinediones like pioglitazone improve insulin sensitivity but should be avoided in heart failure. Acarbose and miglitol delay carbohydrate absorption and are useful for postprandial hyperglycemia. DPP-4 inhibitors like sitagliptin are weight neutral and have a low risk of hypoglycemia. SGLT2 inhibitors such as empagliflozin offer cardiovascular and renal benefits. GLP-1 receptor agonists like liraglutide and semaglutide promote weight loss and improve glycemic control.

Insulin is indicated in type 2 diabetes when there is severe hyperglycemia, ketonuria, or when oral agents fail. It is also used during infections, pregnancy, or surgery. Initiation typically involves a basal insulin with the option of adding premeal boluses as needed.

Insulin Therapy

Insulin preparations vary in onset, peak, and duration of action. Rapid-acting insulins like lispro and aspart start working within 10–15 minutes, peak at 1–2 hours, and last 3–5 hours. Short-acting regular insulin has a slower onset and a peak at 2–4 hours, lasting about 6–8 hours. Intermediate-acting insulin (NPH) has an onset of 1–3 hours, peaks in 4–8 hours, and lasts 12–18 hours. Long-acting insulins such as glargine and detemir have a nearly flat profile with minimal peak and last about 24 hours.

The target blood glucose level in hospitalized patients is typically between 8.3–13.4 mmol/L, while home glucose targets should range between 4–10 mmol/L.

Diabetic Ketoacidosis (DKA)

Features:

- Polyuria, polydipsia, vomiting, abdominal pain
- Kussmaul breathing (acidotic)
- Fruity breath (acetone)
- Dehydration ± altered mental status

Diagnosis:

- Hyperglycemia (>13.9 mmol/L or 250 mg/dL)
- Metabolic acidosis (pH <7.3, HCO? <18 mmol/L)
- Ketonemia or ketonuria

Management:

1. **Fluid Replacement:**

- Normal saline initially
- Switch to 5% dextrose when glucose <14 mmol/L

2. **Insulin Therapy:**
    - IV bolus 0.1 units/kg, then infusion 0.1 units/kg/hr
    - Switch to SC insulin when oral intake resumes
3. **Potassium Replacement:**
    - Start once urine output is confirmed and K+ <5.3 mmol/L
    - Typical total deficit: 300–600 mmol
4. **Bicarbonate:**
    - Only if pH <6.9; use cautiously
5. **Identify and Treat Precipitating Cause:**
    - Infection, missed insulin, myocardial infarction, etc.
6. **Anticoagulation:**
    - Consider prophylaxis with LMWH in bedridden patients

Patient Education and Monitoring

- **SMBG (Self-monitoring of blood glucose)**
- **Hypoglycemia awareness** and management
- **Sick day rules**
- **Foot care** to prevent ulcers
- **Annual screening** : eyes (retinopathy), kidneys (albuminuria), feet (neuropathy)