

DIABETES MELLITUS (DM)

1. WHAT IS DIABETES MELLITUS?

Diabetes mellitus is a **chronic metabolic disorder** characterized by **high blood glucose levels (hyperglycemia)** due to either **insufficient insulin production** (Type 1 DM) or **insulin resistance** (Type 2 DM).

Types of Diabetes Mellitus:

1. **Type 1 Diabetes Mellitus (T1DM)** → Autoimmune destruction of pancreatic beta cells → **Absolute insulin deficiency**
2. **Type 2 Diabetes Mellitus (T2DM)** → Insulin resistance & beta-cell dysfunction → **Relative insulin deficiency**
3. **Gestational Diabetes Mellitus (GDM)** → Diabetes that develops during pregnancy
4. **Other Types:**
 - **MODY (Maturity-Onset Diabetes of the Young)** – Genetic mutations
 - **Secondary Diabetes** (due to medications like steroids, pancreatic diseases, etc.)

2. PATHOPHYSIOLOGY

A. Normal Glucose Metabolism

- **Insulin (from pancreatic beta cells)** allows glucose uptake into cells for energy.
- Insulin also **inhibits liver glucose production** and promotes glucose storage as glycogen.

B. Type 1 Diabetes (T1DM) – Autoimmune Destruction of Beta Cells

- **Cause:** Autoimmune attack against beta cells → No insulin production
- **Effect:** Cells can't absorb glucose → Hyperglycemia & ketone formation (DKA risk!)

C. Type 2 Diabetes (T2DM) – Insulin Resistance & Beta-Cell Dysfunction

- **Cause:** Obesity, sedentary lifestyle, genetic factors
- **Effect:**
 1. Insulin resistance: Cells don't respond to insulin → High blood sugar
 2. Beta-cell dysfunction: Overworked pancreas eventually fails to produce enough insulin
- **T1DM = Insulin Deficiency**
- **T2DM = Insulin Resistance + Beta-Cell Dysfunction**

3. RISK FACTORS FOR DIABETES MELLITUS

A. Type 1 Diabetes (T1DM)

- ◆ Family history (HLA-DR3, HLA-DR4)
- ◆ Autoimmune diseases (thyroid disorders, celiac disease)
- ◆ Viral infections (Coxsackievirus, enteroviruses)

B. Type 2 Diabetes (T2DM)

- ◆ Obesity (especially central/visceral fat)
- ◆ Sedentary lifestyle
- ◆ Family history of diabetes
- ◆ Hypertension, dyslipidemia, metabolic syndrome
- ◆ Poly cystic ovarian syndrome (PCOS)
- ◆ Gestational diabetes history

✦ **T2DM is strongly linked to obesity & lifestyle factors, whereas T1DM is autoimmune.**

4. SYMPTOMS & CLINICAL FEATURES OF DIABETES

Classic Symptoms ("3 P's")

- ✓ **Polyuria (Frequent urination)** – Due to glucose spilling into urine
- ✓ **Polydipsia (Excessive thirst)** – Due to dehydration from excessive urination
- ✓ **Polyphagia (Excessive hunger)** – Due to lack of glucose uptake by cells

Other Symptoms

- **Unexplained weight loss (T1DM)**
- **Fatigue, blurred vision**
- **Slow-healing wounds, frequent infections (UTI, skin infections)**
- **Tingling/numbness (diabetic neuropathy)**

Severe Presentations

🚨 **Diabetic Ketoacidosis (DKA) → More common in T1DM**

- Nausea, vomiting, abdominal pain
- Kussmaul breathing (deep, rapid breathing), fruity breath (acetone smell)
- Severe dehydration, confusion, coma

🚨 **Hyperosmolar Hyperglycemic State (HHS) → More common in T2DM**

- Severe hyperglycemia (>600 mg/dL)
- Extreme dehydration, altered mental status, seizures

✦ **T1DM often presents with DKA, whereas T2DM may develop HHS.**

5. DIAGNOSIS OF DIABETES

Test	Diabetes	Prediabetes	Normal
Fasting Blood Glucose (FPG)	≥126 mg/dL	100-125 mg/dL	<100 mg/dL
HbA1c (3-month glucose average)	≥6.5%	5.7%-6.4%	<5.7%
Oral Glucose Tolerance Test (OGTT, 2-hour post 75g glucose)	≥200 mg/dL	140-199 mg/dL	<140 mg/dL
Random Blood Glucose + Symptoms	≥200 mg/dL	N/A	N/A

📌 Fasting glucose ≥126 mg/dL or HbA1c ≥6.5% confirms diabetes.

6. COMPLICATIONS OF DIABETES

A. Acute Complications

- 🚨 **Diabetic Ketoacidosis (DKA) (T1DM)** – Hyperglycemia + Ketones → Life-threatening!
- 🚨 **Hyperosmolar Hyperglycemic State (HHS) (T2DM)** – Extreme dehydration & hyperglycemia

B. Chronic Complications (Macrovascular & Microvascular)

1. Macrovascular (Large Blood Vessels)

- ✓ Cardiovascular Disease (Heart Attacks, Strokes, Hypertension)
- ✓ Peripheral Artery Disease (PAD) → Risk of foot ulcers, amputations

2. Microvascular (Small Blood Vessels)

- ✓ Diabetic Retinopathy (Blindness) – Damaged blood vessels in the retina
- ✓ Diabetic Nephropathy (Kidney Failure) – Proteinuria → CKD → Dialysis
- ✓ Diabetic Neuropathy (Nerve Damage) – Tingling, numbness, burning pain, foot ulcers

📌 "Diabetes affects the eyes, kidneys, nerves, heart, and blood vessels!"

7. MANAGEMENT OF DIABETES

A. Lifestyle Modifications (First-Line for T2DM)

- ✓ Weight loss (5-10% weight reduction) – Improves insulin sensitivity
- ✓ Exercise (150 min/week) – Reduces blood sugar & heart disease risk
- ✓ Smoking cessation & alcohol moderation
- ✓ Diet:
 - Low refined carbs & sugar
 - High fiber, lean protein, and healthy fats
 - Mediterranean diet & low-carb diet are beneficial

B. Medications for Diabetes

Drug Class	Examples	Mechanism	Used In
Biguanides	Metformin	Reduces liver glucose production	First-line for T2DM
GLP-1 Agonists	Semaglutide, Liraglutide	Increases insulin, weight loss	T2DM, Obesity
SGLT-2 Inhibitors	Empagliflozin, Dapagliflozin	Increases glucose excretion in urine	T2DM, heart & kidney protection
Sulfonylureas	Glipizide, Glyburide	Increases insulin secretion	T2DM (risk of hypoglycemia)
Insulin	Short-acting (Humalog), Long-acting (Lantus)	Replaces insulin	T1DM & advanced T2DM

✦ Metformin is first-line for T2DM, while insulin is essential for T1DM.

C. Insulin Therapy for Type 1 & Severe Type 2 Diabetes

💉 Basal-Bolus Regimen:

- **Basal insulin** (long-acting: glargine, detemir) – Once daily
- **Bolus insulin** (rapid-acting: lispro, aspart) – Before meals

✦ T1DM always requires insulin; T2DM may need it if severe.

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