CHAPTER 13: DIABETES MELLITUS & HYPERGLYCEMIA

(Simplified Notes + Q&A)

13.1 HYPERGLYCEMIA (High Blood Sugar)

Definition:

Hyperglycemia means **increased glucose (sugar) levels in the blood**.
It usually occurs in people with **diabetes mellitus** when:

- Insulin is not produced properly, or
- The body doesn't use insulin effectively.

Causes:

1. **Skipping insulin doses or diabetes medicines**
2. **Eating more carbohydrates than usual**
3. **Less physical activity or no exercise**
4. **Illness or infection**
5. **Stress**
6. **Other medications (like steroids)**

What Happens in the Body:

- Normally, **insulin** (from the *Islets of Langerhans* in the pancreas) helps glucose enter body cells (liver, muscles, fat) for energy.
- In hyperglycemia, there is **not enough insulin**, so glucose **stays in the bloodstream**, increasing blood sugar levels.
- This may damage organs if it stays high for a long time.

Blood Sugar Levels:

- Symptoms usually appear when **blood glucose >180–200 mg/dL (10–11.1 mmol/L)**.

Symptoms (Early Warning Signs):

✅ Frequent urination
✅ Excessive thirst
✅ Increased hunger
✅ Feeling weak or tired
✅ Blurred vision

Q&A: Hyperglycemia

Q1: What is hyperglycemia?
A: It is a condition where blood sugar levels rise above the normal range.

Q2: What hormone controls blood sugar?
A: Insulin, secreted by pancreatic beta cells.

Q3: When do symptoms appear?
A: When blood glucose exceeds 180–200 mg/dL.

Q4: List 3 causes of hyperglycemia.
A: Skipping insulin, illness, eating too much carbohydrate.

Q5: Give two symptoms of hyperglycemia.
A: Excessive thirst and frequent urination.

13.2 DIABETES MELLITUS

Definition:

A **group of metabolic diseases** that cause **chronic hyperglycemia** due to:

- Defects in insulin secretion,
- Defects in insulin action, or
- Both.

Types (as per National Diabetes Data Group):

1. **Type 1 Diabetes Mellitus (T1D)** – Insulin-dependent
2. **Type 2 Diabetes Mellitus (T2D)** – Non-insulin-dependent
3. **Other specific types** – due to genetic defects, drugs, or diseases
4. **Gestational Diabetes Mellitus (GDM)** – occurs during pregnancy

Q&A: Diabetes Mellitus

Q1: What is diabetes mellitus?
A: A group of metabolic disorders causing high blood sugar due to problems with insulin.

Q2: Name four main types of diabetes mellitus.
A: Type 1, Type 2, Other specific types, and Gestational diabetes.

13.3 TYPE 1 DIABETES MELLITUS (T1D)

Definition:

An **autoimmune disease** where the body's immune system destroys **pancreatic beta cells** that produce insulin.

Key Points:

- Results in **absolute insulin deficiency**.
- Patients need **lifelong insulin injections**.
- Without insulin, **diabetic ketoacidosis (DKA)** can occur (a life-threatening condition).

Symptoms:

- Sudden weight loss
- Increased urination, thirst, and hunger
- Fatigue
- Blurred vision

Management:

1. **Insulin therapy** – multiple daily injections
2. **Continuous glucose monitoring**
3. **Education on:**
    - Blood sugar checking
    - Insulin use
    - Ketone testing
    - Diet (carbohydrate counting)
    - Physical activity
    - Treating low blood sugar

- Managing illness days ("sick day rules")

4. **Psychological support**

Important Facts:

- Can develop at any age, not just childhood.
- Makes up **5–10% of all diabetes cases**.

Q&A: Type 1 Diabetes

Q1: What causes Type 1 Diabetes?
A: Autoimmune destruction of insulin-producing pancreatic beta cells.

Q2: What hormone is missing in Type 1 Diabetes?
A: Insulin.

Q3: What happens without insulin?
A: Glucose cannot enter cells, leading to high blood sugar and energy loss.

Q4: What is diabetic ketoacidosis (DKA)?
A: A dangerous complication of Type 1 Diabetes due to lack of insulin.

13.4 TYPE 2 DIABETES MELLITUS (T2D)

Definition:

Type 2 Diabetes involves:

- **Insulin resistance** (body cells don't respond to insulin properly), and
- **Inadequate insulin secretion**.

Causes / Risk Factors:

- Overweight or obesity
- Lack of exercise
- Unhealthy diet
- Family history
- Increasing age

Diagnosis (as per ADA – American Diabetes Association):

Test	Diagnostic Value
Fasting Plasma Glucose (FPG)	≥126 mg/dL (7.0 mmol/L)
Random Plasma Glucose	≥200 mg/dL (11.1 mmol/L) + symptoms
HbA1c	≥6.5% (used optionally)

Symptoms:

- Polyuria (frequent urination)
- Polydipsia (thirst)
- Polyphagia (hunger)
- Fatigue
- Slow healing wounds

Pathogenesis Comparison:

Type	Cause	Insulin
Type 1	Autoimmune destruction of beta cells	Absent
Type 2	Insulin resistance + secretion defect	Present but not effective

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Q&A: Type 2 Diabetes

Q1: What is the main problem in Type 2 Diabetes?
A: Insulin resistance and reduced insulin production.

Q2: What is the fasting glucose level for diagnosing diabetes?
A: ≥126 mg/dL.

Q3: What is the HbA1c level for diagnosing diabetes?
A: 6.5% or higher.

Q4: Which type is more common?
A: Type 2 Diabetes.

13.5 GESTATIONAL DIABETES MELLITUS (GDM)

Definition:

Occurs **during pregnancy** due to **hormonal and metabolic changes** that make the body resistant to insulin.

Q&A: Gestational Diabetes ki

Q1: When does gestational diabetes occur?
A: During pregnancy.
Q2: What causes it?
A: Hormonal changes that increase insulin resistance.

13.6 OGTT (Oral Glucose Tolerance Test)

Purpose:

Used to diagnose **Gestational Diabetes Mellitus (GDM)** and **borderline diabetes** cases when fasting glucose is not clearly diabetic.

Patient Preparation:

- Eat normally (≥150g carbs/day) for 3 days before test.
- Fast 12 hours before the test (only water allowed).
- No smoking, tea, coffee, or exercise before or during the test.
- Stop any medicine that affects glucose (like steroids or diuretics).

Test Procedure:

1. Confirm 12-hour fast.
2. Take fasting blood sample.
3. Give **75g anhydrous glucose** in 250–300 mL water (drink within 5 min).
    - If using glucose·H_2O → use 82.5g.
4. Wait 2 hours (no eating, only water).
5. Take another blood sample after 2 hours.
6. Record both results.

Normal OGTT Values:

Category	2-hour Plasma Glucose (mg/dL)	mmol/L
Normal	<140	<7.8
Impaired (Prediabetes)	140–199	7.8–11.1
Diabetes	≥200	≥11.1

Q&A: OGTT

Q1: What does OGTT stand for?
A: Oral Glucose Tolerance Test.

Q2: Why is OGTT done?
A: To diagnose gestational diabetes or when fasting glucose is uncertain.

Q3: How much glucose is given to an adult?
A: 75g of anhydrous glucose.

Q4: What are normal 2-hour glucose values?
A: Less than 140 mg/dL.

Q5: What value confirms diabetes after OGTT?
A: 200 mg/dL or higher after 2 hours.

Summary Chart

Type	Cause	Insulin	Common In	Treatment
Type 1	Autoimmune destruction of β-cells	Absent	Children/Young	Insulin
Type 2	Insulin resistance	Present (ineffective)	Adults	Diet + Oral meds ± Insulin
Gestational	Pregnancy hormones	Reduced sensitivity	Pregnant women	Diet + Insulin if needed

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