SNS COLLEGE OF ALLIED HEALTH SCIENCES

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai

DEPARTMENT OF OPERATION THEATRE AND ANAESTHESIA TECHNOLOGY

COURSE NAME : BIOCHEMISTRY

TOPIC : GLUCOSE TOLERANCE TEST

Background

- Blood glucose is regulated in large measure by two pancreatic hormones, **insulin** and **glucagon**.
- Both are peptides secreted by the pancreas (as an "**endocrine function**")
- **Insulin** stimulates blood glucose uptake by body tissues, which functionally will reduce blood glucose levels.
- When the muscles and liver take up blood glucose, and extra blood glucose not needed for cell metabolism can be converted to a storage form of glucose called **glycogen**

Diabetes mellitus

Diabetes mellitus is a disorder of fuel metabolism. The two major syndromes are classified as

1. **Type I diabetes** (formerly **insulin-dependent diabetes mellitus**) IDDM
2. **Type II diabetes** (formerly **non-insulin-dependent diabetes mellitus NIDDM** and more recently referred to as "**insulin resistance**"

- Both are characterized by **hyperglycemia** (high blood glucose) and inability to properly metabolize glucose.
- In someone suffering from diabetes - the blood is overloaded with glucose, but tissues starve as they are unable to use it.

Clinical significance

- To assess insulin performance, clinicians use the **oral glucose tolerance test** (OGTT)

GLUCOSE TOLERANCE TEST

- It is a laboratory method to check how the body breaks down (metabolizes) blood sugar, and how quickly it is cleared from the blood.
- The test usually used to test for diabetes, insulin resistance, impaired beta cell function and reactive hypoglycemia.

Preparation

➢The patient is instructed not to restrict carbohydrate intake in the days or weeks before the test.

➢The test should not be done during an illness, as results may not reflect the patient's glucose metabolism when healthy.

➢ Usually the OGTT is performed in the morning as glucose tolerance can exhibit a diurnal rhythm with a significant decrease in the afternoon.

➢ The patient is instructed to fast (water is allowed) for 8–12 hours prior to the tests

Procedure

- A zero time (baseline) blood sample is drawn.

- The patient is then given a 75g of glucose in a 300 ml solution and drink within a 5-minute time frame.

- Blood is drawn every 30 min for 2 hr to measure of glucose (blood sugar), and sometimes insulin levels.
- The intervals and number of samples vary according to the purpose of the test.
- For simple diabetes screening, the most important sample is the 2 hour sample and the 0 and 2 hour samples may be the only ones collected.

Results

A- Fasting plasma glucose - below **(110 mg/dL)** in normal person.

- Fasting levels between **(110 and 125 mg/dL)** indicate pre-diabetes
- Fasting levels repeatedly at or above **(126 mg/dL)** are diagnostic of diabetes.

B- 1 hour GTT (Glucose Tolerance Test) glucose level below **(180 mg/dL)** is considered normal.

C- 2 hour GTT (Glucose Tolerance Test) glucose level below **(140 mg/dL)** is normal.

- Blood plasma glucose between **(140 mg/dL) and (200 mg/dL)** indicate "pre-diabetes.
- Blood plasma levels above **(200 mg/dL)** at 2 hours confirm a diagnosis of diabetes.

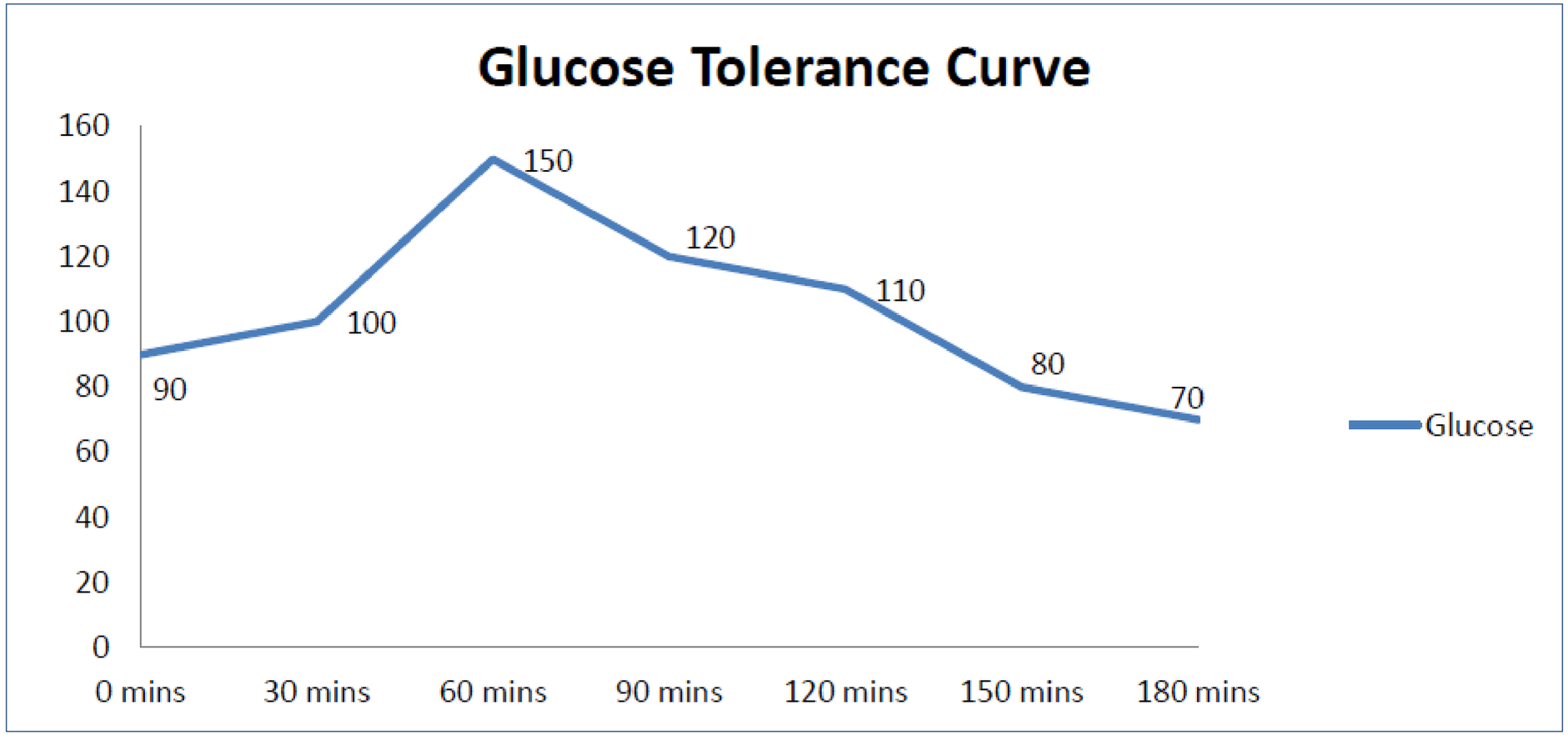
Glucose tolerance curve

- A curve is plotted with the blood glucose levels on the vertical axis against the time of collection on the horizontal axis.
- The curve so obtained is called glucose tolerance curve.

Laboratory profile of a normal person after glucose load

Sample	Fasting (Zero sample)	30 minutes	60 minutes	90 minutes	120 minutes	150 minutes	180 minutes
Blood Glucose (mg/dl)	90	100	150	120	110	80	70
Urinary Glucose	Nil	nil	nil	nil	nil	nil	nil

Normal Glucose tolerance curve



Normal glucose tolerance curve

i) Fasting blood glucose (Zero hour sample)- is 90 mg /dl, which is well within the normal range (Normal 60-100 mg/dl).

ii) There is rise of blood glucose after glucose load and the peak value is observed at 1 hour. This is due to absorption of glucose from the intestine.

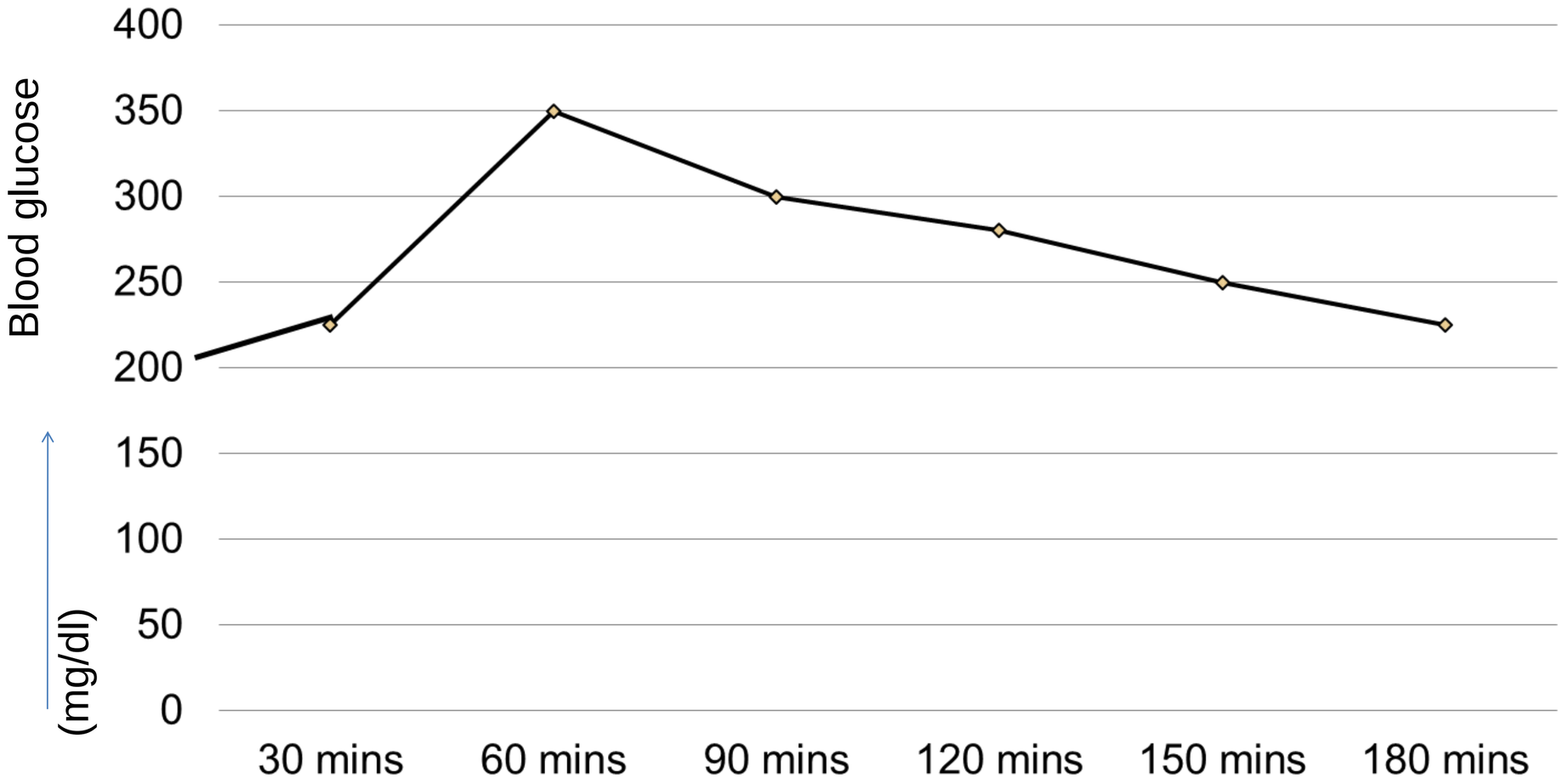
iii) The blood glucose level return to the fasting level within 2hour.

iv) Glucose is not found in the urine samples.

Laboratory profile of a diabetic patient after glucose load

Sample	Fasting (Zero sample)	30 minutes	60 minutes	90 minutes	120 minutes	150 minutes	180 minutes
Blood Glucose (mg/dl)	200	225	350	300	275	250	225
Urinary Glucose	+	+	+	+	+	+	+

Diabetic curve



Diabetic curve

1) Fasting blood glucose is higher than normal
2) The highest value is attained at 1 hour to 1 hour 30 minutes.
3) Glucose is found in almost all the urine samples.
4) The blood glucose level does not return to the fasting level even within 2hour 30 minutes.

TYPE OF GLUCOSE TOLERANCE TEST

- Standard Oral glucose tolerance test
- I/V Glucose tolerance test
- Mini Glucose tolerance test

RENAL GLYCOSURIA

- Blood glucose levels are within the normal limits but urine glucose is positive.
- Glucose tolerance curve is normal.
- Thus glucose is found in some of the samples depending upon the renal threshold.
- There is lowering of renal threshold due to renal tubular defect in glucose absorption.
- GTT is also useful in the diagnosis of this inherited renal tubular defect.

CAUSE OF RENAL GLYCOSURIA

- Early diabetes mellitus,
- Pregnancy,
- Renal disease,
- Heavy metal poisoning
- Deficiency of carrier protein (SGLT-2).
- Renal glycosuria can also be observed in children of diabetic parents.

IV GLUCOSE TOLERANCE TEST

- This test is undertaken for patients with malabsorption .
- Under these conditions oral glucose load is not well absorbed and the results of oral glucose tolerance test become inconclusive.
- The values for the IV GT test differ slightly from those of the oral GT test because IV glucose is absorbed faster.

PROCEDURE

- I/V glucose tolerance test is carried out by giving 25 g of glucose dissolved in 100 ml intravenous injection within 5 minutes.
- Completion of infusion is taken as 0 time.
- Blood samples are taken at 10 minutes interval for the next hour.
- The peak value is reached within a few minutes and the value touches to near normal in 45-60 minutes.

INTERPRETATION

- In normal individuals, blood glucose level returns
- to normal within 60 minutes.
- In diabetes mellitus, decline is slow.
- The initial values are attained in 120 minutes.

CLINICAL SIGNIFICANCE

Decrease Glucose Tolerance

- **Diabetes mellitus (DM):** *This disease is defined by glucose intolerance and hyperglycemia.*
- **Acute stress response**
- **Cushing syndrome**
- **Chronic renal failure**
- **Glucagonoma**
- **Acute pancreatitis**
- **Diuretic therapy**
- **Corticosteroid**
- **Myxedema**
- **After gastrectomy.**

GLUCOSE TOLERANCE

Increased Glucose Tolerance

- Increased carbohydrate tolerance is observed in all conditions that cause hypoglycemia:-
  - Hypopituitarism
  - Hyperinsulinism
  - Hypothyroidism
  - Adrenal Cortical Hypofunction

Assessment

1. What is GTT?

2. Types of GTT?

3. Procedure involved in GTT?

4. Types of curves on the basis of absorption oif Glucose in our body?

5. Normal values of GTT?

6. Explain its Clinical significance?

THANK YOU