HYPERGLYCAEMIA AND DIABETES MELLITUS

By

Dr. Bushra Mahmood Hussein

Hyperglycaemia may be due to:

- Intravenous infusion of glucose-containing fluids,
- Severe stress (usually a transient effect) such as trauma, myocardial infarction or cerebrovascular accidents,
- Diabetes mellitus or impaired glucose regulation.

Diabetes Mellitus

- Diabetes mellitus is a group of metabolic diseases characterized by elevated blood glucose levels (hyperglycemia) resulting from defects in insulin secretion , insulin action or both .
- The chronic hyperglycemia of diabetes is associated with long-term damage , dysfunction and failure of different organs especially the eyes , kidneys , nerves , heart and blood vessels .

Glucose: Obligate fuel for CNS & RBC's

- CNS/Brain:

-Dependent on glucose as primary source of fuel

-Uses ~120g glucose/day of total 160-200 g/d

- RBC:

-Dependent on glucose

-Lack mitochondria

Diabetes Mellitus

- DM is caused by an absolute or relative insulin deficiency .
- It has been defined by the WHO on the basis or laboratory findings , as a fasting venous plasma glucose concentration greater than 126 mg/dl or greater than 200 mg/dl two hours after a carbohydrate meal or two hours after the oral ingestion of the equivalent of 75 gm of the glucose even if the fasting conc. is normal .

Types of diabetes

- DM is divided into the following types :

A:insulin –dependent DM (IDDM) or type1: It is caused by an inability of the body to produce insulin , IDDM causes : -

1.hyperglycemia (abnormally blood glucose conc.)

2.poly dypsia (excessive thirst)

3.poly uria (excessive urine production)

4.poly phagia (increased appetite)

5.weight loss (due to increased breakdown of fat and tissues protein) .

- IDDM due to the destruction of the insulin producing B-cells of the pancreatic islets.

- It is usually presents during childhood or before age 40 .-It has been suggested that many cases follow a viral infection ,which has destroyed the B-cells of the pancreatic islets .-Treatment requires insulin .
- Type 1 Diabetes Mellitus results from cell-mediated autoimmune destruction of the insulin-secreting cells of pancreatic B-cells.
- The most important antibodies are:

1. Islet cell cytoplasmic antibodies.

2.Insulin autoantibodies.

3. Antibodies to the isoform of glutamic acid decarboxylase.

4.Insulinoma –associated antigens.

5. Zinc transporter.

- In this type occur :-
- Lowering of the pH of the blood due to circulating keto acids (acidosis) .
- Increased level of lipids , fatty acids and cholesterol in the blood (lipemia).
- Negative nitrogen balance due to the conversion of more amino acids into glucose (increased gluconeogenesis) .
- Increased production of KBs by the liver and their incomplete utilization by tissues leading to their accumulation in blood (ketosis)and elimination in urine(ketonuria).
- This condition called diabetic ketoacidosis one of the most important complication of type 1 DM.

- increased tendency to develop cataract in the eye and arteriosclerotic lesions of blood vessels .

B. Non-insulin depended DM (NIDDM) or type 2 DM:

-Often due to insulin resistance by the tissues (resistance to its action or of post receptor defect) .

-Onset is most common during adult life (after age 40) .

-Most common form .

-Treatment with hypoglycemia agent or insulin may be required .

Contributing factors of type 2 :–

-Obesity .

-Lack of physical activity .

-Age (onset of puberty is associated with increased insulin resistance)

-Genetic predisposition .

-Conditions associated with insulin resistance such as poly cystic ovary syndrome , hypertension and dyslipidemia .

Treatment for type 1 and type 2 of DM

-Taking injections of insulin .

-Sometimes taking medicines by mouth (oral hypoglycemic agent).

-Making healthy food choices .

-Being physically active .

-Controlling your blood pressure levels . Blood pressure is the force of blood flow inside your blood vessels .

-Controlling your cholesterol levels .

- **C**:Gestational diabetes :
- Gestational diabetes can develop when a woman is pregnant.
- Pregnant woman make hormones that can lead to insulin resistance.
- Overweight or obese woman have a higher chance of gestational diabetes .
- Gestational diabetes often goes away after the baby is born . However , a woman who had gestational diabetes is more likely to develop type 2 diabetes later in life .

Diagnosis of Diabetes Mellitus:

- 1.HbA1C > 6.5% or
- 2.Random venous plasma [glucose] of (200 mg/dl) or more, or
- 3. Fasting plasma [glucose] of (126 mg/dl) or more.
- A single result is sufficient in the presence of typical hyperglycaemic symptoms of thirst and polyuria. In their absence, a venous plasma [glucose] in the diabetic range should be detected on at least two separate occasions on different days.

Hypoglycemia

-A blood glucose conc. of 45mg/dl or less .

-The brain and the CNS need a continuous supply of blood glucose to serve as fuel for energy metabolism .

-Transient hypoglycemia can cause cerebral dysfunction .Sever prolonged hypoglycemia can cause brain death .

-Glucagon and epinephrine are the most important hormones in preventing it .

- Low blood glucose can come on fast and can be caused by :
- 1 . Taking too much diabetes medicine .
- 2 . Missing or delaying a meal .
- 3 . Being more physically active than usual .
- 4 . Drinking alcoholic beverages .

Notes :

- 1 . Hypoglycemia should be treated by urgent intravenous administration of to 20ml of at least 10 percent and in adults 50 percent glucose solution after with drawal of a blood glucose sample for glucose and insulin assays .
- 2. Absolute insulin deficiency due to pancreatic diseases (chronic pancreatitis,haemochromatosis , cystic fibrosis) .
- 3. Relative insulin deficiency due to the excessive growth hormones (acromegaly)or increased plasma glucocorticoid conc.due to the administration of steroid (Cushing's diseases) . In human the major glucocorticoid is cortisol (hydrocortisone),Glucocorticoid stimulate the degradation of muscle protein .