

Diabetes Mellitus

Lecture 3

Objectives:

1. To give an account on intermediate hyperglycaemia:
 - A. Impaired glucose tolerance
 - B. Impaired fasting glycaemia
2. To give an account on assessment of glycaemic control:
 - A: Self-monitoring of blood glucose
 - B: Glycated haemoglobin
 - C: Glycated albumin
 - D: 1,5 Anhydroglucitol

Intermediate hyperglycaemia:

Formerly called: Pre-diabetes

Include:

1. Impaired glucose tolerance
2. Impaired fasting glycaemia

Impaired glucose tolerance:

FPG: < 7.0 mmol/l

(< 126 mg/dl)

PPG: ≥ 7.8 mmol/l, < 11.1 mmol/l

(≥ 140 mg/dl, < 200 mg/dl)

HbA1c: 5.7 – 6.4 %

Impaired fasting glycaemia:

FPG: ≥ 5.6 mmol/l, < 7.0 mmol/l

(≥ 100 mg/dl, < 126 mg/dl)

PPG: < 7.8 mmol/l

(< 140 mg/dl)

Note: These patients have increased risks of progression to frank diabetes with time and of macrovascular atheromatous disease

Other Definitions:

Potential Diabetes: Normal OGTT but have an increased risk of developing DM for genetic reasons like individuals who have 1st degree relative with DM

Latent Diabetes: Normal OGTT but develop abnormal OGTT in conditions imposing burden on Beta-cells like pregnancy, infections, MI, stress, drugs.

Assessment of Glycaemic Control:

1. Self-monitoring blood glucose (SMBG).

“SERIAL blood glucose measurements”

SMBG is regarded as reliable, convenient, easily, and safe system to be used by patients.

2. Glycated Haemoglobin (HbA1c).

HbA1c refers to hemoglobin that bound, non-enzymatically and irreversibly to glucose.

Glycosylation occur to valine on the β -chain N-terminal results in β -N1-deoxyfructosyle hemoglobin.

HbA1c has a beneficial effect for both diagnosis and screening of diabetes as well as assessment of the status of glycaemic control.

HbA1c reflects average plasma glucose over the previous 6–8 weeks.

On the other hand, HbA1c has its own disadvantage which represented by factors that affecting its level like haemoglobinopathies, renal failure, haemolytic anemia, and malaria.

Interpretation of HbA1c:

- | | |
|---|--------------------------------------|
| 1. Optimal Control: | HbA1c: 6.5 – 7.0 % |
| 2. Sub-optimal (acceptable) Control: | HbA1c: 7.0 - 8.0 % |
| 3. Poor Control: | HbA1c \geq 8.0 % |

3. Glycated albumin (Fructosamine) "GA".

Albumin is the most abundant extracellular protein that account for about 60 percent of total blood protein with a concentration of 36-52 g/L with a half-life of about 20-21 days.

Serum fructosamine (FA) is glycoprotein results from non-enzymatically binding of glucose to protein molecule the process known as (protein glycation). FA assess the glycemic control for short period limited to the last 2-3 weeks.

GA is a useful alternative in assessing the glycemic control in patients with haemoglobinopathies, renal failure, and patients with high rate of RBC turnover, or planning for pregnancy.

4. 1,5 Anhydroglucitol (1,5 AG):-

It is naturally occurring monosaccharide structurally similar to the D-glucose with an exception for the first position hydroxyl group which is reduced in 1,5 AG. It shows high renal tubular reabsorption by more than 99%.

During the period of hyperglycemia when the plasma glucose exceeds 180 mg/dl (renal threshold for glucose), this inhibits 1,5 AG reabsorption via sodium glucose co-transporter 4 (SGLT4) leading to urinary loss of 1,5 AG and dramatic reduction of its plasma level.

The degree of the reduction in the 1,5 AG serum level is directly proportional to glycosuria severity. With restoration of normal plasma glucose level, 1,5 AG is increased again, showing reversible relationship to the glycemic control recovery.

1,5 AG is regarded as sensitive marker for short term glycemic control (predictor for postprandial hyperglycemia) as it reflect the glycemic control over a period ranging from 2 days to 2 weeks.