

Diabetes Mellitus

(Lecture 3)

Objectives

- 1. To give an account on intermediate hyperglycaemia.**
- 2. To give an account on assessment of glycaemic control.**

Contents

- 1. Intermediate hyperglycaemia.**
- 2. Assessment of glycaemic control.**

Intermediate Hyperglycaemia

Also called: **Pre-diabetes**

Include:

1. Impaired glucose tolerance
2. Impaired fasting glycaemia

Impaired glucose tolerance

FPG: $< 7.0 \text{ mmol/l}$
 $(< 126 \text{ mg/dl})$

PPG: $\geq 7.8 \text{ mmol/l}, < 11.1 \text{ mmol/l}$
 $(\geq 140 \text{ mg/dl}, < 200 \text{ mg/dl})$

Hb A1c: $5.7 - 6.4 \%$

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)

Hb A1c: 5.7 – 6.4 %

Notes:

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

Other Definitions

“ Latent Diabetes “

Normal OGTT

but develop abnormal OGTT

**in conditions imposing burden on *B- cells* like
pregnancy, infections, MI, stress, drugs**

Assessment of Glycaemic Control

- 1. Self Monitoring Blood Glucose (SMBG):**
- 2. Glycated hemoglobin (HbA1c)**
- 3. Glycated albumin “GA”:**
- 4. 1,5 Anhydroglucitol (1,5 AG):-**

1. Self Monitoring Blood Glucose (SMBG):

Serial blood glucose measurements ***“Diabetic Calendar”***

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

- ***SMBG*** is an important component of modern therapy for patients with diabetes mellitus.
- ***SMBG*** has been recommended for people with diabetes to achieve a specific level of glycemic control and to prevent complications particularly hypoglycemia.

The goals of *SMBG*:

- To collect detailed information about blood glucose levels at many time points:
- TO enable maintenance of a more constant or stable blood glucose level.

Impact of SMBG

1. In T1D:

SMBG has been associated with improved health outcomes. Increasing frequency of **SMBG** was linearly correlated with reductions in HbA_{1c} .

2. In T2D:

Higher frequency of **SMBG** was associated with better glycemic control among insulin-treated patients who were able to adjust their regimen

Traumatic SMBG

Finger testing of glucose is TOO traumatic to patients by pricking their finger with a lancet.

This can be uncomfortable and painful for many, which can result in:

Less frequent testing

(Loss of adherence to testing)

Consequently:

a poorer control of blood sugar

NON-Traumatic SMBG

- To overcome this problem, several companies are looking for non-traumatic (needle-free) alternatives for blood glucose measurement that could make the lives of millions of patients with diabetes easier.

2. Glycated hemoglobin (HbA1c)

- HbA1c is referred to the hemoglobin that bound stably, non-enzymatically and irreversibly to the glucose.**
- Glycosylation occur to valine on the β -chain N-terminal which results in β -N1-deoxyfructosyl hemoglobin.**

2. Glycated hemoglobin (HbA1c)

- HbA1c has a beneficial effect for both diagnosis and screening purpose of diabetes as well as the assessment of the status of glycaemic control.**
- HbA1c reflects average plasma glucose over the previously 6 – 8 weeks.**

2. Glycated hemoglobin (HbA1c)

□ HbA1c has its own disadvantage which represented by conditions affecting its level like:

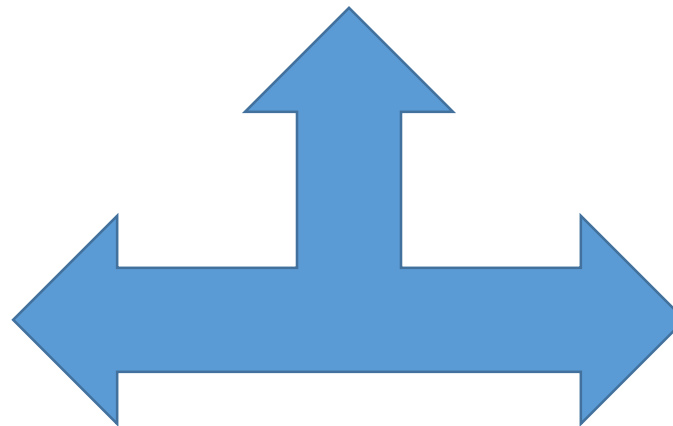
1. Haemoglobinopathies
2. Renal failure
3. Haemolytic anaemias
4. Malaria.

2. Glycated hemoglobin (HbA1c):

Interpretation of Hb A1c:

Optimal Control:
Hb A1c:
6.5–7.0 %

**Sub-optimal
Control:**
Hb A1c:
7.0–8.0 %



Poor Control:
Hb A1c:
≥ 8.0 %

Status of Glycaemic Control

3. Glycated albumin (Fructosamine) “GA”:

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

3. Glycated albumin (Fructosamine) “GA”:

- **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.**

3. Glycated albumin (Fructosamine) “GA”:

- **FA is a useful alternative in assessing the glycemic control in patients with:**
 - 1. Haemoglobinopathies**
 - 2. Renal failure**
 - 3. Patients with high rate of RBC turnover**
 - 4. Planning for pregnancy .**

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

- ❑ **1.5 AG 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.**
- ❑ **1,5 AG shows a high renal tubular reabsorption by more than 99%.**

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

- ❖ During the **period of hyperglycemia** when the plasma glucose exceeded 180mg/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 dramatically **reduction of its plasma level.**

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

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

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

- **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.**