

Investigations for the Diagnosis and Management of Diabetes Mellitus

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Learning Outcomes

- What are the different types of diabetes mellitus?
- What is the aetiopathogenesis of each type?
- What are the diagnostic tests?
- How do we monitor the patients for glycaemic control and long-term complications?

Learning Outcomes

- How would you detect acute metabolic complications of diabetes mellitus?
 - Clinically?
 - Biochemically?
- What are the principles of screening for
 - Type 2 diabetes?
 - Gestational diabetes?

Why do we have to learn about diabetes?

❖ It is the commonest endocrine and metabolic disease

❖ According to *IDF, 540 million (10.5%) adults worldwide have diabetes in 2021, with a forecasted increase to 783 million (12.2%) by 2045.

❖ Prevalence in Sri Lanka is 11.5%

❖ The projected diabetes prevalence for the year 2030 in Sri Lanka is 13.9%.

❖ A major risk factor for

– Cardiovascular diseases

– Chronic kidney disease

– Retinopathy and blindness

Katulanda, P., Constantine, G.R., Mahesh, J.G., Sheriff, R et al (2008), Prevalence and projections of diabetes and pre-diabetes in adults in Sri Lanka—Sri Lanka Diabetes, Cardiovascular Study (SLDCS). Diabetic Medicine, 25: 1062-1069.

IDF- International diabetes federation

What are the different types of diabetes?

- Type 1
- Type 2
- Other specific types
- Gestational diabetes

Aetiological Types

Type 1

- Absolute deficiency of Insulin
- Results from auto immune destruction of β cells

Type 2

- Progressive reduction in insulin secretion in the presence of insulin resistance
- Obesity and physical inactivity are risk factors
- Strong genetic predisposition

Other specific types

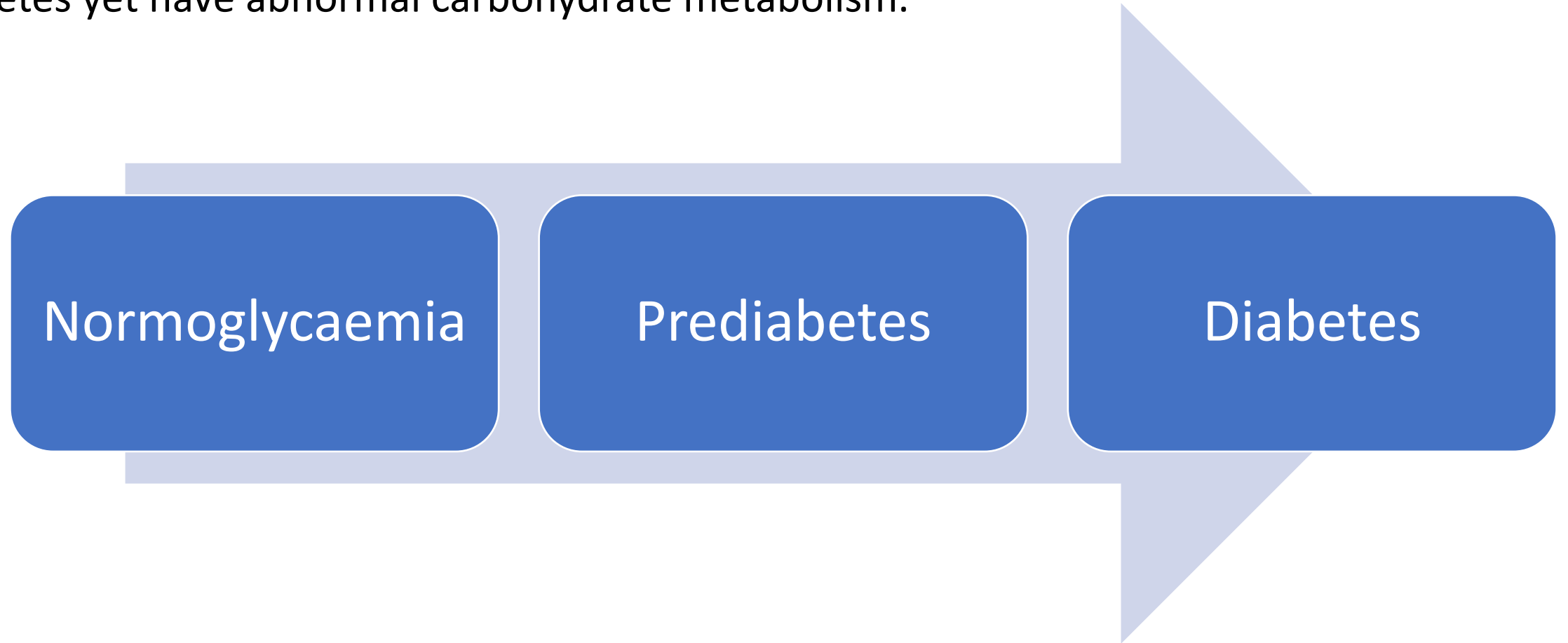
- Monogenic diabetes syndromes
 - Neonatal diabetes
 - Maturity onset diabetes of the young (MODY)
- Diseases of the exocrine pancreas
- Endocrinopathies
- Drug induced

Gestational diabetes mellitus

- Diabetes diagnosed in the 2nd or 3rd trimester of pregnancy

What is pre-diabetes?

Prediabetes” is the term used for individuals whose glucose levels do not meet the criteria for diabetes yet have abnormal carbohydrate metabolism.



Categories of Pre-diabetes

- Impaired fasting glycaemia (IFG)
 - Impaired glucose tolerance (IGT)
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- Both are risk factors for
 - Diabetes
 - Cardiovascular disease

What are the diagnostic tests?

Fasting Plasma Glucose

A minimum of an 8 hour fast

HbA1c

Standardized testing is required

Random Plasma Glucose

Sampling done irrespective of the time of last meal

2 hour value of an OGTT

Performed according to WHO guidelines

HbA1c is unsuitable as a diagnostic test:

- Clinical suspicion of type 1 DM
- Iron and B12 deficiency
- Haemolytic anaemias/haemoglobinopathies
- Chronic liver disease
- Chronic kidney disease (Stages 4 and 5)

What are the principles of diagnosis?

- In symptomatic individuals
 - One abnormal test

- In asymptomatic individuals
 - Two abnormal tests

What are the diagnostic thresholds?

Test	FPG	2hour OGTT	HbA1c	RPG
Cut-off	≥ 7 mmol/L	≥ 11.1 mmol/L	≥ 6.5 %	≥ 11.1 mmol/L

Prediabetes – Diagnostic Thresholds

Test	Cut-off	Category
Fasting Plasma Glucose	5.6 -6.9 mmol/L	Impaired Fasting Glycemia
Two hour OGTT	7.8 –11.0 mmol/L	Impaired Glucose Tolerance
HbA1c	5.7–6.4 %	Prediabetes

What are the laboratory tests used for monitoring control?

- HbA1c (<7%)
- Fasting plasma glucose (<7 mmol/L)
- Postprandial plasma glucose (< 10 mmol/L)

Complications of Diabetes Mellitus

- What are the lipid abnormalities?
- What are the microvascular complications?

What are the tests to detect complications?

- Urine for protein (if negative)
- Urine for albumin/creatinine ratio
- Serum creatinine and eGFR
- Lipid profile

What are the metabolic complications?

- Diabetic ketoacidosis

- seen in patients with type 1 diabetes, if they
- are previously undiagnosed
- have stopped insulin therapy or
- have inter-current illness

- Hyperosmolar hyperglycaemic state

- Seen in patients with uncontrolled type 2 diabetes

- Hypoglycaemia

- Lactic acidosis may occur as a complication of Metformin therapy

Hypoglycaemia

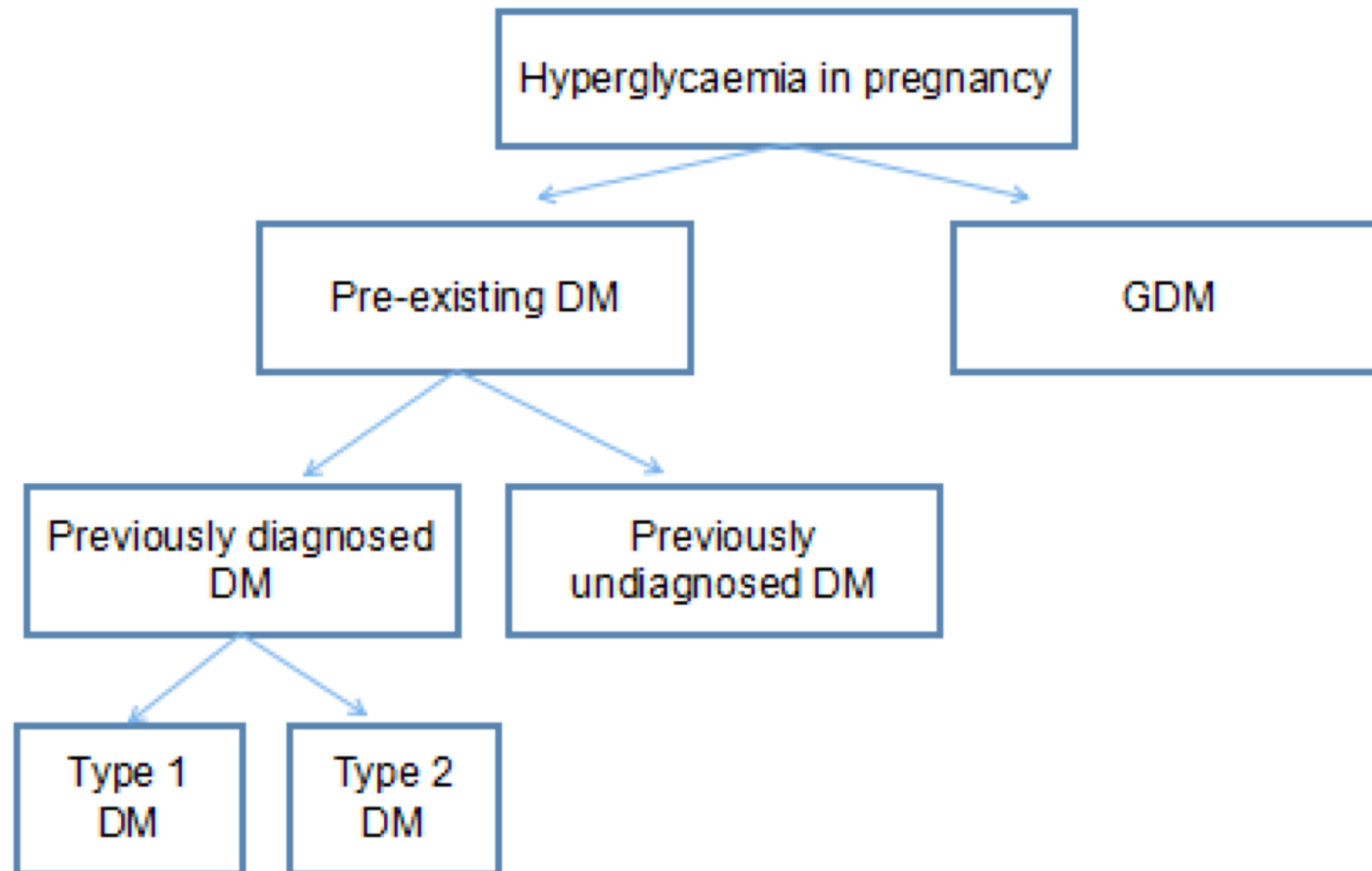
- What is the plasma glucose threshold defining hypoglycaemia in adults?
- What are the symptoms of hypoglycaemia?
- What are the causes of hypoglycaemia in an adult?

What are the essential investigations for metabolic complications?

- Capillary blood glucose –in ward
- Urine for glucose –in ward
- Urine for ketones –in ward
- Random plasma glucose
- Serum electrolytes –plain tube
- Blood urea –plain tube
- Serum creatinine–plain tube
- Arterial blood gas analysis –heparinized syringe

Hyperglycaemia in Pregnancy (HIP)

Classification of hyperglycemia in pregnancy



Detection & Diagnosis of Pre-Gestational DM

- Screen type 2 diabetes at the first prenatal visit in all mothers;
 - FPG > 7 mmol/L
 - HbA1c > 6.5%
- Diagnosis of GDM
 - Perform oral glucose tolerance test (Fasting, 1 and 2 hour samples are collected)

Diagnosis of GDM

- Repeat OGTT to be done at 20 –28 weeks of POA.
- Repeated in 3rd trimester if clinically indicated in mothers with normal results.

References

- Guidelines and Recommendations for Laboratory Analysis in the Diagnosis and Management of Diabetes Mellitus Clin Chem 57.6 e1 -e47 (2011)
- Clinical Chemistry by William Marshall –Chapter 13
- Diabetes mellitus –Management Guidelines 2018 by the Ceylon College of Physicians

Thank you