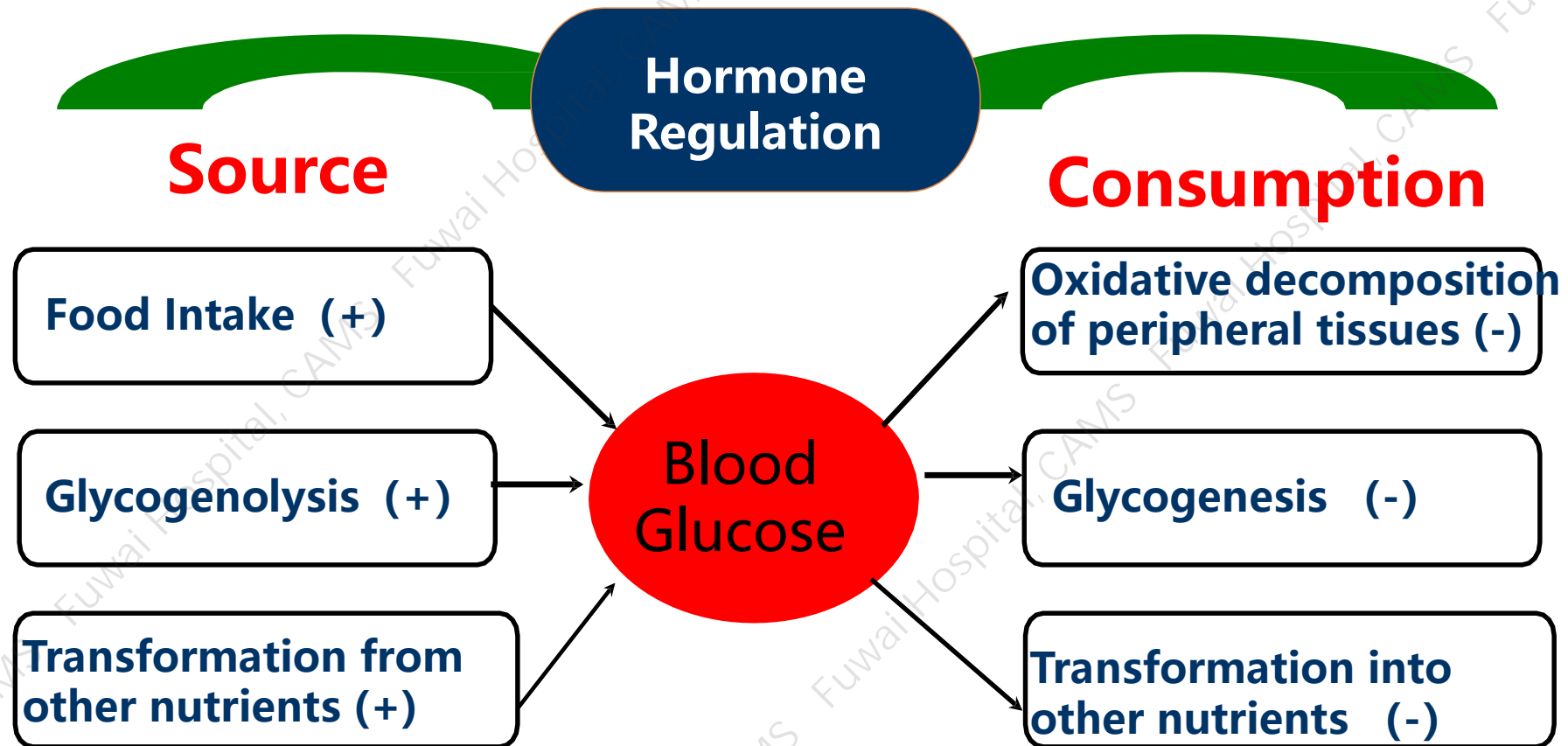# An Overview of Diabetes

Prof. Qiu-Hong Gong
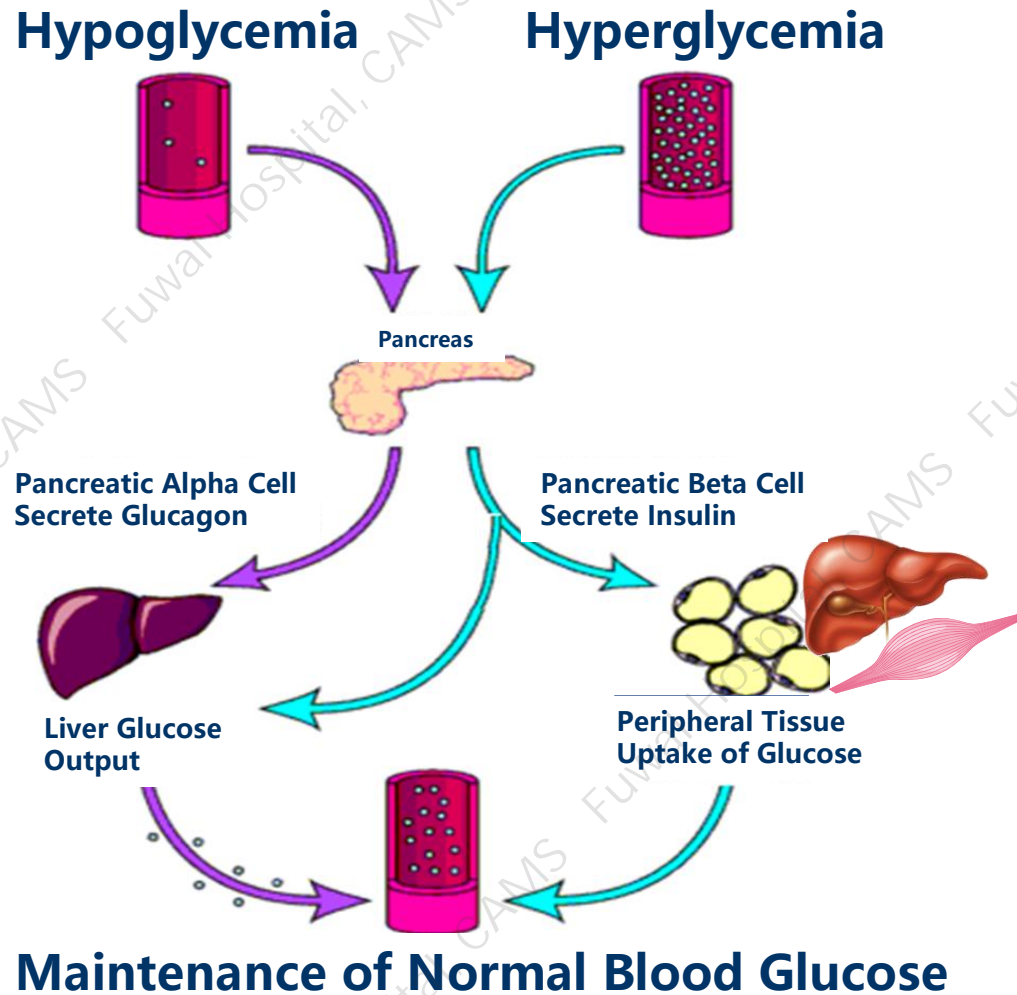
Fuwai Hospital, CAMS & PUMC

9th Sept, 2021

Contents

- **Normal Blood Glucose Regulation**

- Diagnosis and Classification of Diabetes

- Screening and Evaluation of Diabetes

Normal Blood Glucose Regulation

Hormone Regulation

Source

Consumption

Food Intake (+)

Glycogenolysis (+)

Transformation from other nutrients (+)

Blood Glucose

Oxidative decomposition of peripheral tissues (-)

Glycogenesis (-)

Transformation into other nutrients (-)

Normal Blood Glucose Regulation

Regulation of Insulin Secretion

Additional Secretion

Basal insulin secretion：24U

Glucose-stimulated insulin secretion：24U

Basal secretion：24U
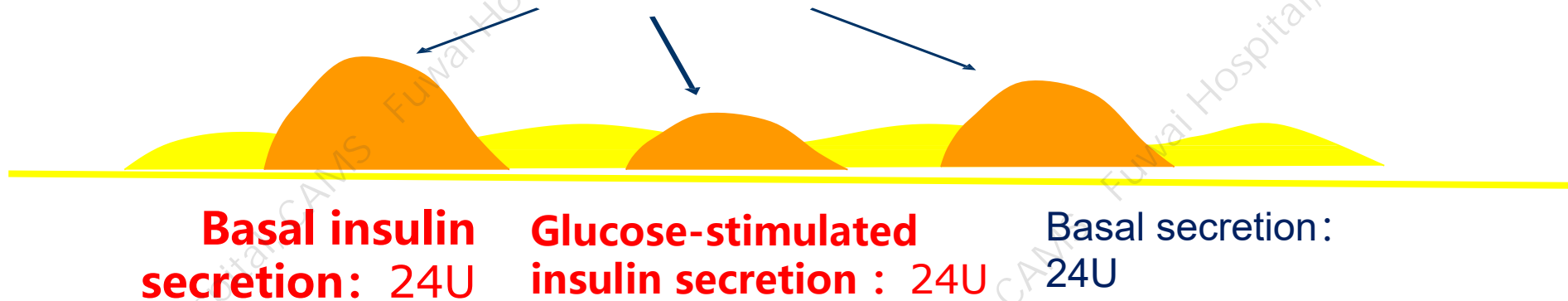
Regulation of Insulin Secretion

Phase 1: rapid secretion phase

B cells were stimulated with glucose and showed a rapid secretion peak after an incubation period of 0.5-1.0 min, which lasted for 5-10 min and then decreased

Phase 2: delayed secretion phase

A slow but persistent secretory peak following the rapid secretion phase, about 30 minutes after stimulation

**Insulin secretion following intravenous glucose administration**
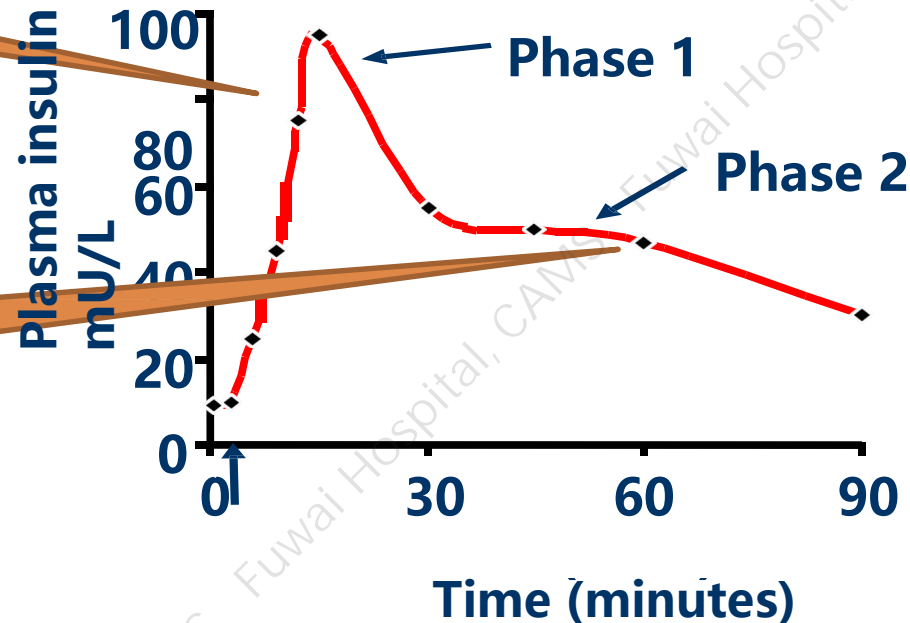
Plasma insulin mU/L

Phase 1

Phase 2

100

80
60
40

20

0

0   30   60   90

Time (minutes)

Contents

What is Diabetes Mellitus?

Diabetes mellitus is a metabolic disease characterized by **chronic hyperglycemia** caused by deficiency of **insulin secretion** or/and **insulin dysfunction**. Chronic hyperglycemia can lead to long-term damage, dysfunction and failure of various tissues, especially the eyes, kidneys, nerves and cardiovascular systems.

潘长玉主译，《Joslin 糖尿病学》，2007，338。
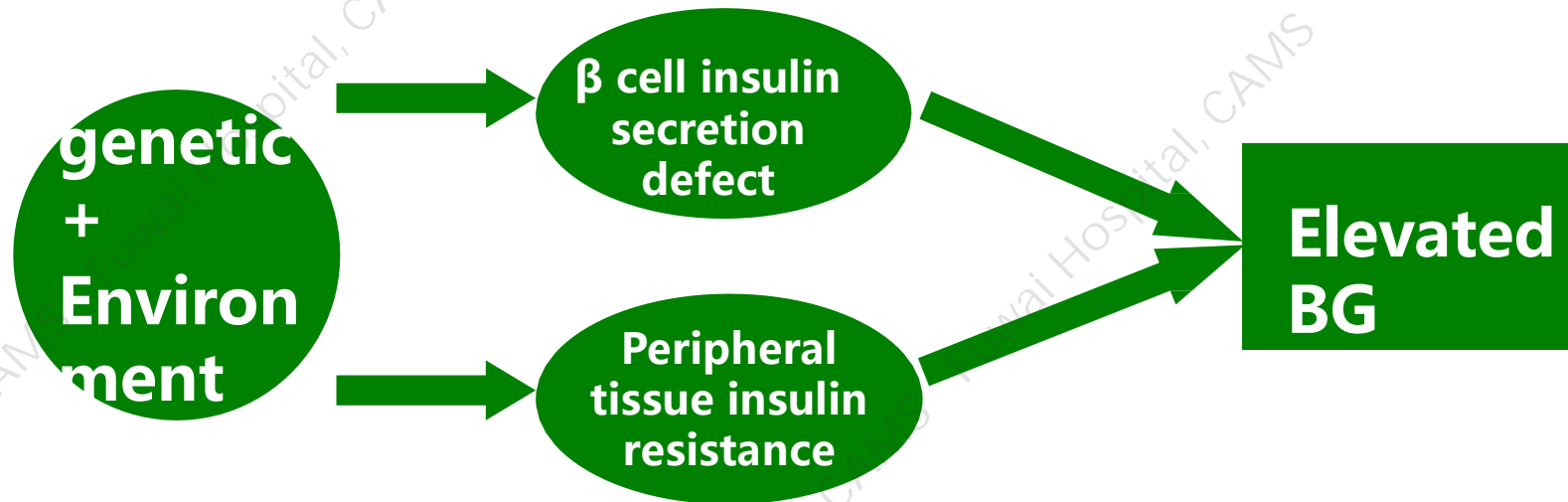
Pathogenesis of Diabetes Mellitus - Octet
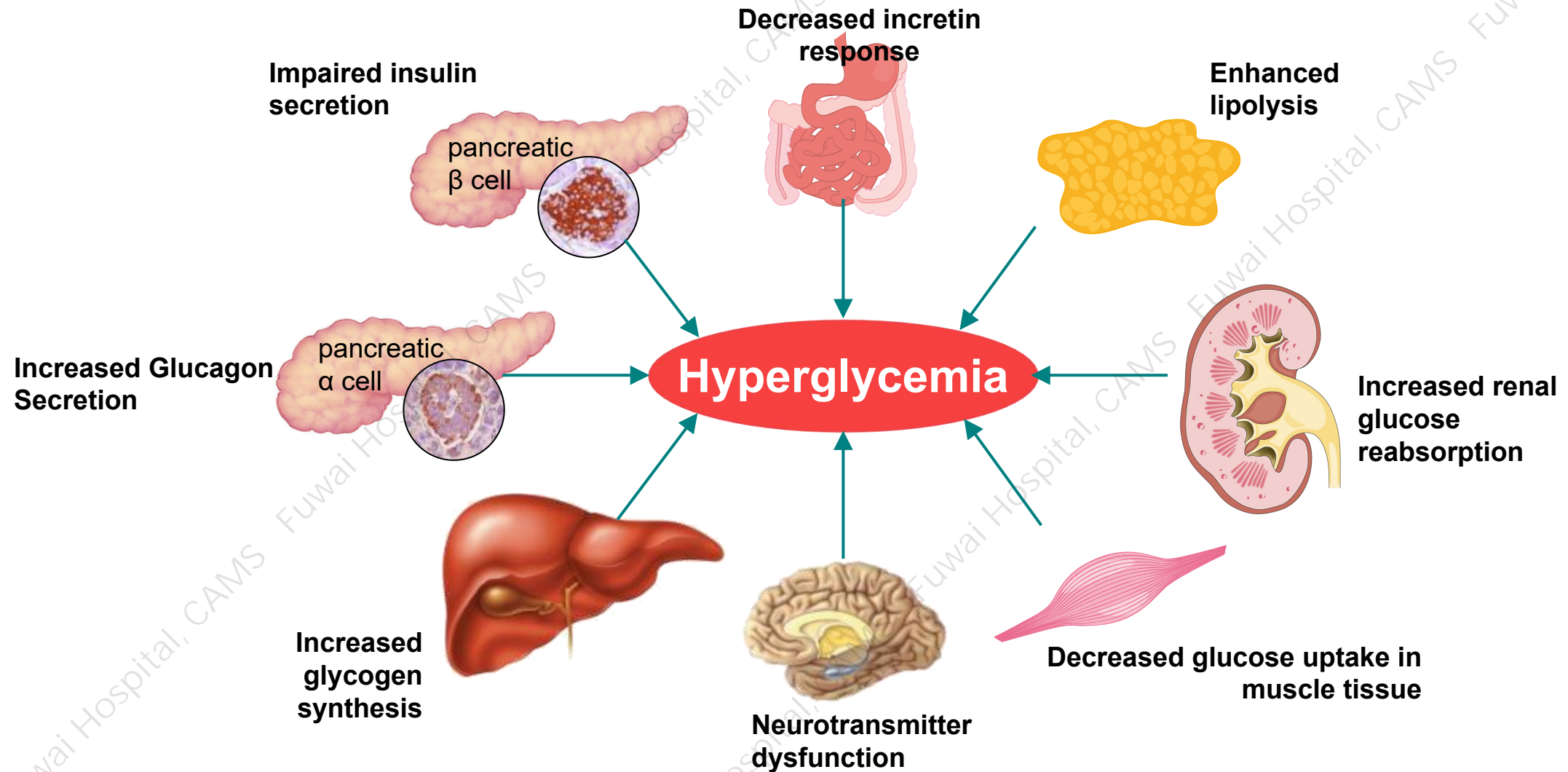
Categories of hyperglycemia (WHO 1999)

Glucometabolic state	Venous Plasma Glucose (mmol/L)	
	FPG	OGTT 2hPG
Normal PG	< 6.1	< 7.8
IFG	≥6.1, < 7.0	< 7.8
IGT	< 7.0	≥7.8, < 11.1
Diabetes	≥7.0	≥11.1

Diagnosis of diabetes

| Diagnostic criteria	Venous Plasma Glucose (mmol/L) or HbA$_{1C}$ levels
Typical symptoms of diabetes	
plus random plasma glucose	≥11.1
or plus FPG	≥7.0
or plus OGTT 2hPG	≥11.1
or plus HbA1C level	≥6.5%
If no typical symptoms of diabetes were observed, patients must be retested on a different day to confirm diabetes.	

- The clinical diagnosis of diabetes should be based on venous plasma glucose rather than capillary blood glucose test results
- WHO (1999) diagnostic criteria for diabetes were used
- HbA1c≥6.5% can be used as supplementary diagnostic criteria for diabetes in health care facilities that use standardized testing methods and have strict quality control (U.S. National Hemoglobin A1c Standardization Program, China Hemoglobin A1C Consistency Study Program)

中国2型糖尿病防治指南(2020版)

Classification of Diabetes Mellitus

Classification	Clinical Features
T1DM (≈5%)	• The number of beta cells decreased or disappeared, and insulin secretion was significantly decreased or absent
T2DM(>90%)	• Decreased insulin secretion (or) insulin resistance
Gestational diabetes	• Diagnosed during pregnancy
Specific type of diabetes	• Beta cell functional gene defect • Genetic defects in insulin action • Exocrine disease of the pancreas • Endocrine disease • Diabetes caused by drugs or chemicals • infection • Uncommon immune-mediated diabetes mellitus • Other genetic syndromes associated with diabetes

The Onset and Development of T2DM
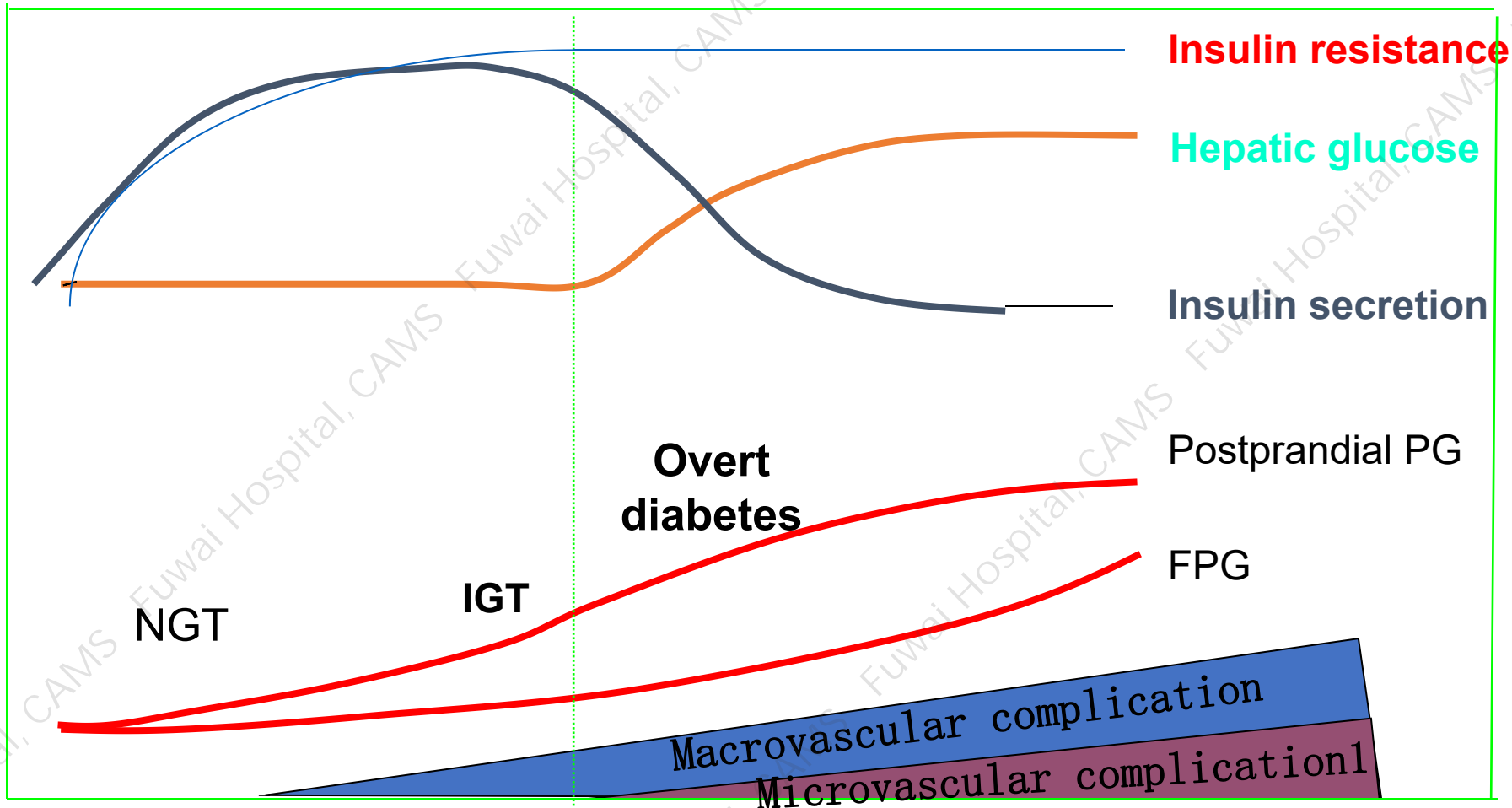
Common laboratory tests for diabetes

Plasma glucose	Test for blood glucose levels
OGTT	Diagnosis of diabetes or impaired glucose regulation (IGR)
Urine glucose test	Indirectly reflecting blood glucose levels
HbA$_{1c}$	reflects the average level of blood glucose 8 to 12 weeks before the test
ketone body in blood and urine	Diagnose DKA and ketosis
Blood lactate	① Diagnosis of lactic acidosis ② for the treatment and monitoring of biguidine drugs
Plasma insulin concentration	To determine islet β cell function
Serum C-peptide	To determine islet β cell function
Islet autoantibodies	Help determine classification
Quantification of urinary albumin	To determine diabetic nephropathy
Glucose clamp	Hyperglycemic clamp technique——Gold standard for beta cell function Hyperinsulinemic euglycemic clamp——Assess insulin sensitivity/insulin resistance

Contents

- **Normal Blood Glucose Regulation**

- **Diagnosis and Classification of Diabetes**

- **Screening and Evaluation of Diabetes**

Screening and Evaluation of Diabetes

- Populations at high risk of diabetes should be screened for diabetes.

- Patients with diabetes should have a detailed assessment at the time of initial diagnosis.

- Patients with diabetes should be regularly evaluated for metabolic control and complications.

Screening and Evaluation of Diabetes

Populations at high risk of diabetes should be screened for diabetes.

Definition of high-risk populations: (1) History of prediabetes; (2) Age ≥ 40 years; (3) BMI≥24 kg/m2 and/or central obesity (waist circumference ≥90 cm in men and ≥85 cm in women); (4) First-degree relatives with T2DM; (5) Sedentary lifestyle; (6) History of GDM (for women); (7) Polycystic ovary syndrome (PCOS); (8) Acanthosis nigricans; (9) Hypertension or receiving antihypertensive therapy; (10) Dyslipidemia (high-density lipoprotein cholesterol [HDL-C] ≤ 0.91 mmol/L and/or triglycerides [TG] ≥ 2.22 mmol/L) or receiving lipid-lowering therapy; (11) Atherosclerotic cardiovascular disease (ASCVD); (12) history of steroid use; (13) Long-term use of antipsychotics and/or antidepressants and statins; (14) The total score of Chinese diabetes risk score (CDRS) ≥25.

Screening Methods

The screening method was a two-point method, i.e., fasting glucose +75 g oral glucose tolerance test (OGTT) 2 h glucose.

Diabetes screening can help early detection of diabetes

Chinese Diabetes Risk Score (CDRS)

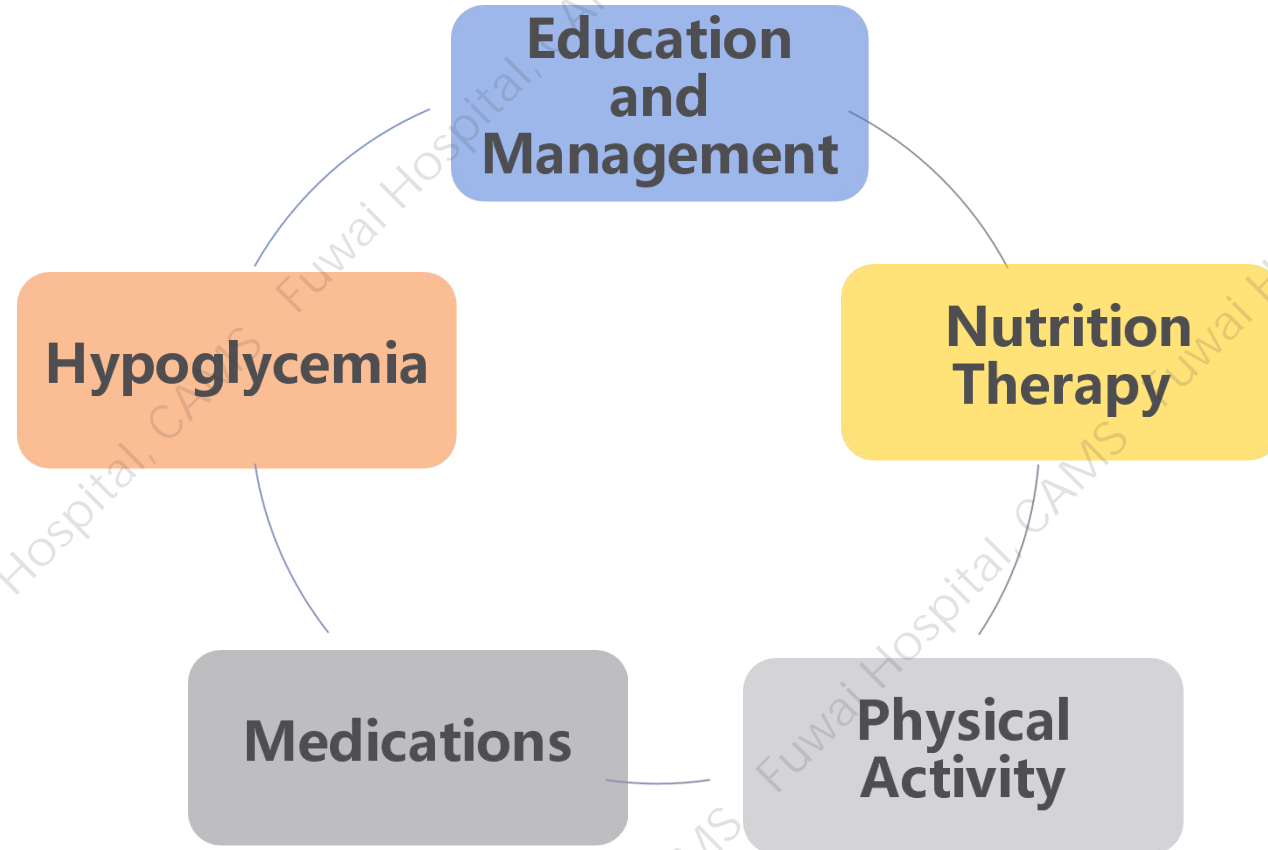| Indicators	Score	Indicators	Score
Age (years)		BMI (kg/m2)	
20~24	0	<22.0	0
25~34	4	22.0~23.9	1
35~39	8	24.0~29.9	3
40~44	11	≥30.0	5
45~49	12	Waist circumference (cm)	
50~54	13	Male <75.0, Female<70.0	0
55~59	15	M 75.0~79.9, F 70.0~74.9	3
60~64	16	M 80.0~84.9, F 75.0~79.9	5
65~74	18	M 85.0~89.9, F 80.0~84.9	7
Systolic BP (mmHg)		M 90.0~94.9, F 85.0~89.9	8
<110	0	M ≥95.0, F ≥ 90.0	10
110~119	1	Family history of diabetes (parents, siblings, children)	
120~129	3	No	0
130~139	6	Yes	6
140~149	7	Gender	
150~159	8	Female	0
≥160	10	Male	2

Patients with a total score ≥25 were classified as at high risk of diabetes

Evaluation of Diabetes

Frequency	Inquiry	PE	Urine	HbA1c	Liver Function	Renal Function	Lipid	Ultrasound	ECG	ABPM	Fundus Oculi	Neuropathy
Initial visit	√	√	√	√	√	√	√	√	√	√	√	√
Every visit	√	√										
Once every six months				√								
Once a year			√		√	√	√	√	√	√	√	√

Note: Urine tests include routine urine tests and urinary albumin/creatinine ratio; Renal function tests should include GFR, uric acid; Ultrasound examination included abdominal ultrasound, carotid artery and lower limb vascular ultrasound. Ambulatory blood pressure monitoring(ABPM) is limited to patients with hypertension; Patients with poor blood glucose control should be examined for HbA1c every 3 months. Patients with abnormal liver function, kidney function, blood lipid, urine, electrocardiogram, ultrasound, fundus and neuropathy should increase the frequency of these test.

Management of Diabetes

Thanks!