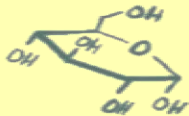
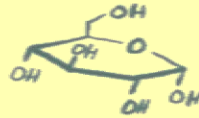
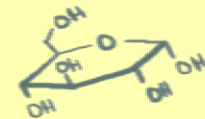


University of Thi-Qar
College of Nursing



DIABETES MELLITUS



Prepared By:

د . قاسم علي العمري

Diabetes Mellitus

Definition

- **A multisystem disease related to:**
 - Abnormal insulin production, or**
 - Impaired insulin utilization, or**
 - Both of the above**
- **Leading cause of heart disease, stroke, adult blindness, and non-traumatic lower limb amputations**

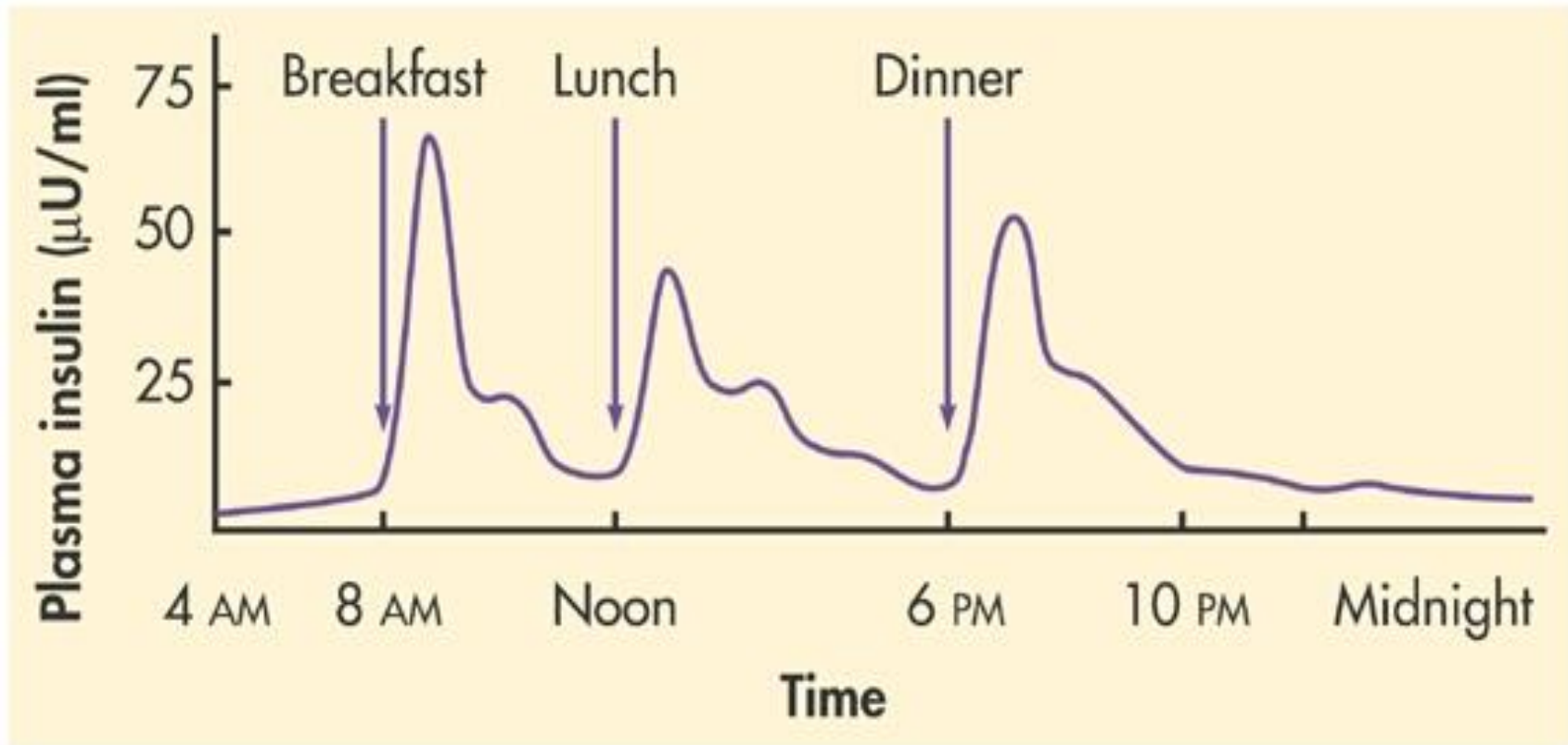
Normal Insulin Metabolism

- **Insulin**

- Produced by the β cells in the islets of Langerhans of the pancreas

- Facilitates normal glucose range of 3.9 – 6.7 mmol/L

Insulin Secretion



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Fig. 47-1

Normal Insulin Metabolism

- ❑ Promotes glucose transport from the bloodstream across the cell membrane to the cytoplasm of the cell
- ❑ Analogous to a “key” that unlocks the cell door to allow glucose in



Normal Insulin Metabolism

- **↑ Insulin after a meal:**
 - Stimulates storage of glucose as glycogen
 - Inhibits gluconeogenesis
 - Enhances fat deposition in adipose tissue
 - Increases protein synthesis

Normal Insulin Metabolism

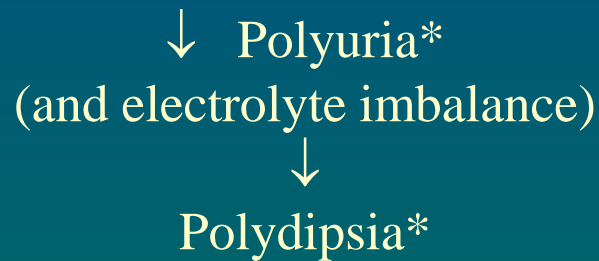
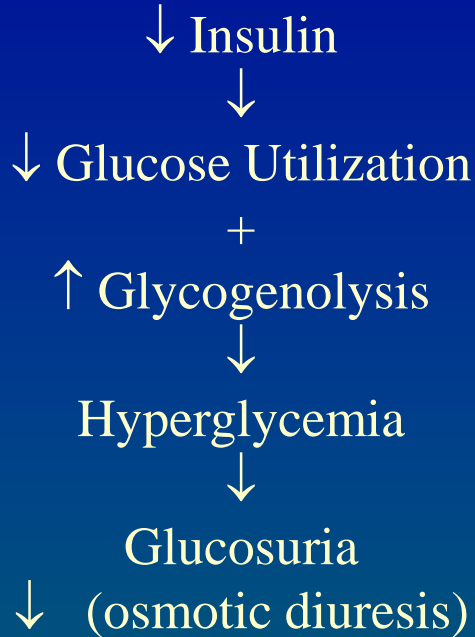
□ Fasting state

- Counter-regulatory hormones (especially glucagon) stimulate glycogen → glucose

□ When glucose unavailable during fasting state

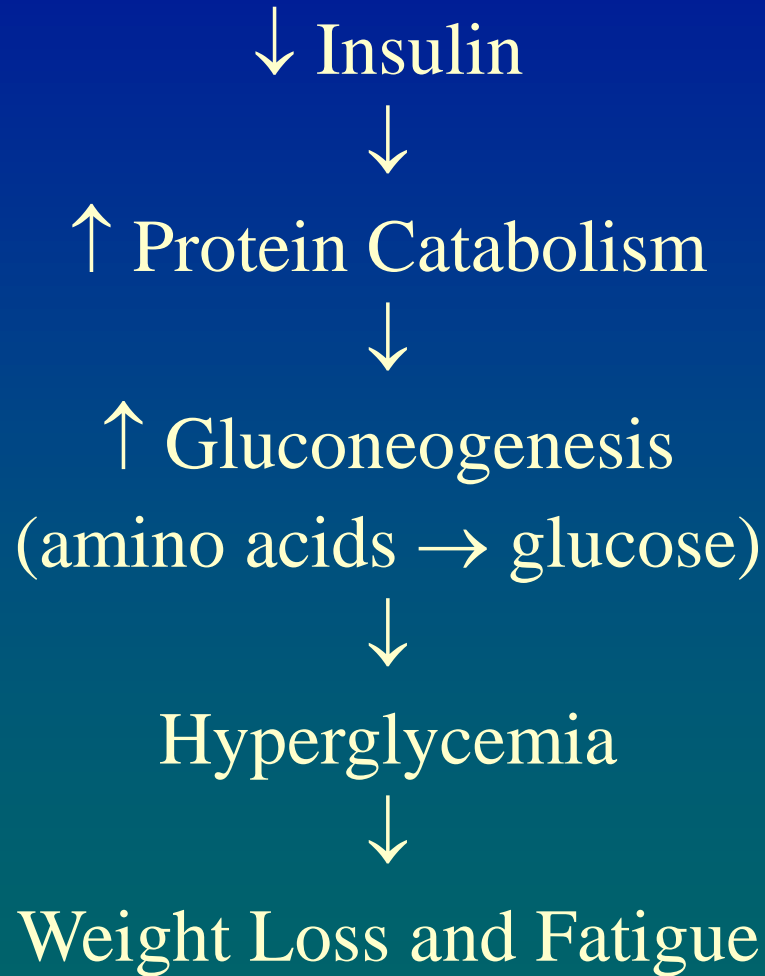
- Lipolysis (fat breakdown)
- Proteolysis (amino acid breakdown)

ALTERED CHO METABOLISM

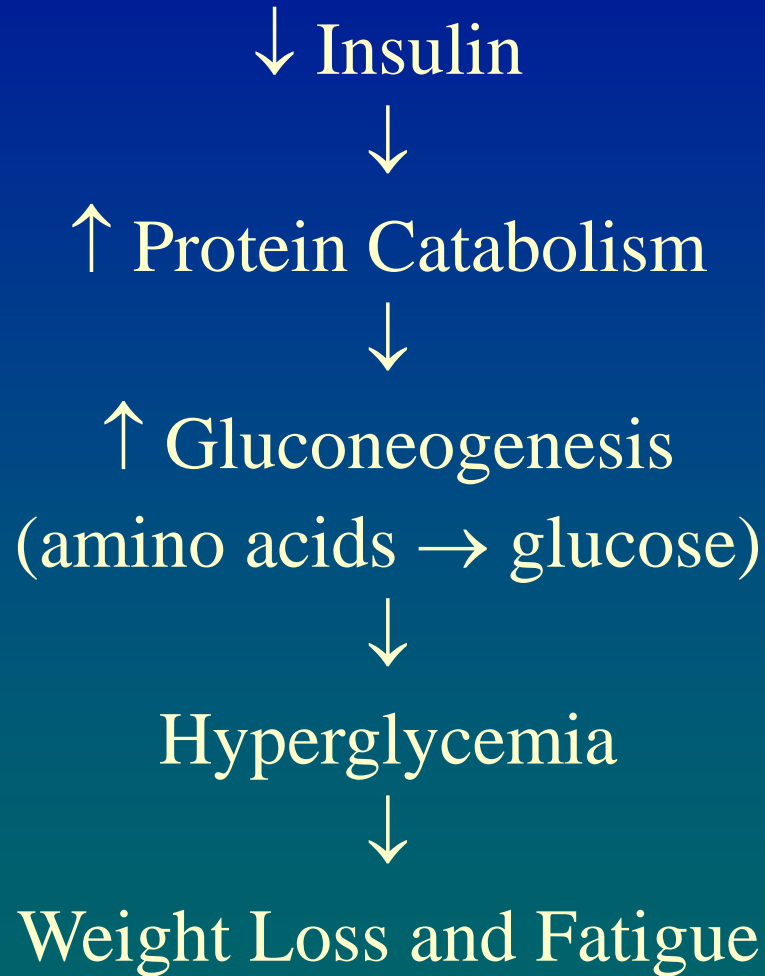


* Hallmark symptoms of diabetes

ALTERED PROTEIN METABOLISM



ALTERED PROTEIN METABOLISM



ALTERED FAT METABOLISM

↓ Insulin



↑ Lipolysis



↑ Free fatty acids + ketones



Acidosis + Weight Loss

Type 1 Diabetes Mellitus

- ❑ Formerly known as “juvenile onset” or “insulin dependent” diabetes
- ❑ Most often occurs in people under 30 years of age
- ❑ Peak onset between ages 11 and 13



Type 1 Diabetes Mellitus

Etiology and Pathophysiology

- Progressive destruction of pancreatic β cells**
- Autoantibodies cause a reduction of 80% to 90% of normal β cell function before manifestations occur**

Type 1 Diabetes Mellitus

Etiology and Pathophysiology

- **Causes:**
 - Genetic predisposition
 - Exposure to a virus



Type 1 Diabetes Mellitus

Onset of Disease

- **Manifestations develop when the pancreas can no longer produce insulin**
 - **Rapid onset of symptoms**
 - **Present at ER with impending or actual ketoacidosis**

Type 1 Diabetes Mellitus

Onset of Disease

- Weight loss**
- Polydipsia (excessive thirst)**
- Polyuria (frequent urination)**
- Polyphagia (excessive hunger)**
- Weakness and fatigue**
- Ketoacidosis**

Type 1 Diabetes Mellitus

Onset of Disease

- **Diabetic ketoacidosis (DKA)**
 - **Life-threatening complication of Type 1 DM**
 - **Occurs in the absence of insulin**
 - **Results in metabolic acidosis**

Clinical Manifestations

Type 1 Diabetes Mellitus

- Polyuria**
- Polydipsia**
- Polyphagia**
- Weight loss**

Type 2 Diabetes Mellitus

- **Accounts for 90% of patients with diabetes**
- **Usually occurs in people over 40 years old**
- **80-90% of patients are overweight**

Type 2 Diabetes Mellitus

Etiology and Pathophysiology

- **Insulin resistance**
 - **Body tissues do not respond to insulin**
 - **Results in hyperglycemia**
- **Decreased (but not absent) production of insulin**

Type 2 Diabetes Mellitus

Onset of Disease

- Gradual onset**
- Person may go many years with undetected hyperglycemia**
- Marked hyperglycemia (27.6 – 55.1 mmol/L)**

Clinical Manifestations

Type 2 Diabetes Mellitus

- Non-specific symptoms**
- Fatigue**
- Recurrent infections**
- Prolonged wound healing**
- Visual changes**

Gestational Diabetes

- ❑ Develops during pregnancy
- ❑ Detected at 24 to 28 weeks of gestation
- ❑ Associated with ↑ risk for cesarean delivery, perinatal death, and neonatal complications

Secondary Diabetes

- **Results from another medical condition or due to the treatment of a medical condition that causes abnormal blood glucose levels**
 - Cushing syndrome (e.g. steroid administration)**
 - Hyperthyroidism**
 - Parenteral nutrition**

Diabetes Mellitus

Diagnostic Studies

- **Fasting plasma glucose level >7 mmol/L**
- **Random plasma glucose level > 11.1 mmol/L plus symptoms**
- **Impaired Glucose Tolerance Test – patient is “challenged” with glucose load. Patient should be able to maintain normal BG. Diabetes if BG > 11.1 mmol/L 2 hr post challenge**
- **Hemoglobin A1C test (glycosylated Hgb)**
 - **Reflects amount of glucose attached to Hgb over life of RBC**
 - **Indicates overall glucose control over previous 90 – 120 days**

Diabetes Mellitus

Collaborative Care

- **Goals of diabetes management:**
 - Reduce symptoms**
 - Promote well-being**
 - Prevent acute complications**
 - Delay onset and progression of long-term complications**

Diabetes Mellitus

Collaborative Care

- Patient teaching**
- Nutritional therapy**
- Drug therapy**
- Exercise**
- Self-monitoring of blood glucose**

Diabetes Mellitus

Drug Therapy: Insulin

- **Exogenous insulin:**
 - Required for all patient with type 1 DM**
 - Prescribed for the patient with type 2 DM who cannot control blood glucose by other means**

Diabetes Mellitus

Drug Therapy: Insulin

- **Types of insulin**
 - **Human insulin**
 - Most widely used type of insulin**
 - Cost-effective**
 - ↓ Likelihood of allergic reaction**

Diabetes Mellitus

Drug Therapy: Insulin

- **Types of insulin**
 - Insulins differ in regard to onset, peak action, and duration
 - Different types of insulin may be used for combination therapy

Insulin Preparations

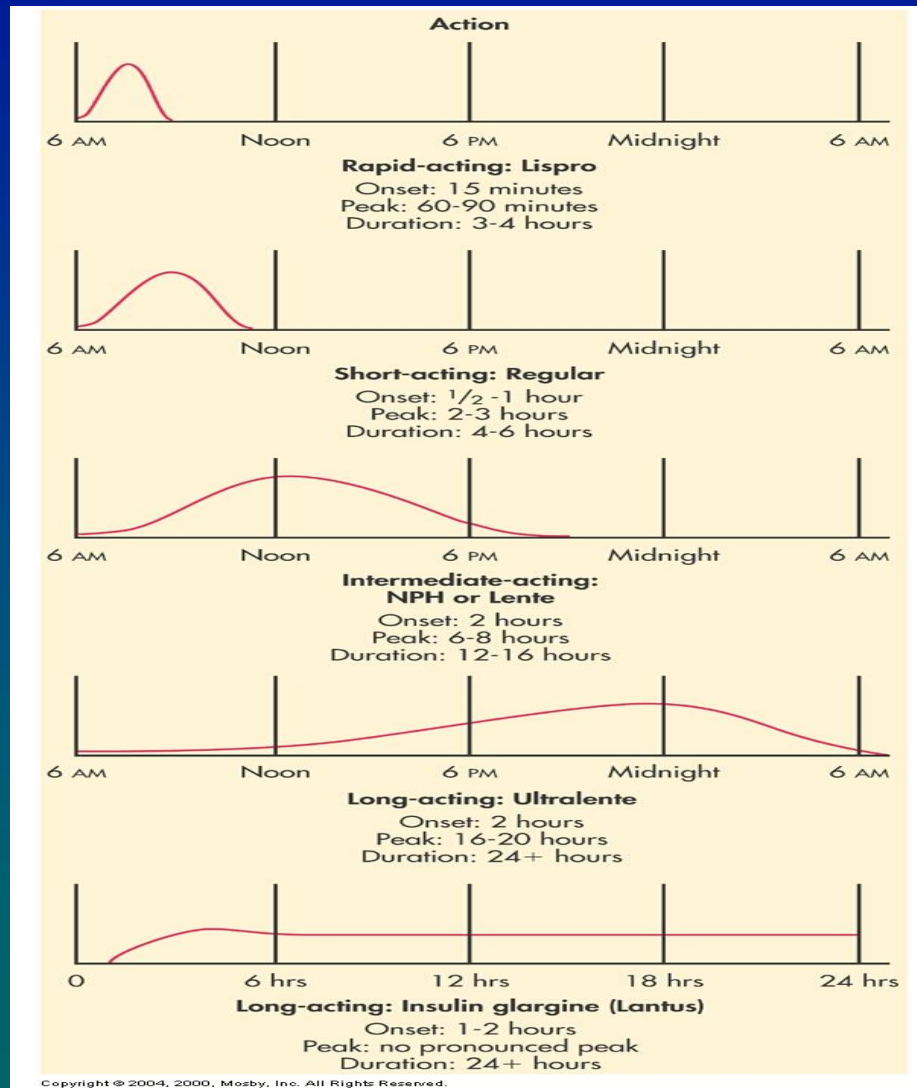


Fig. 47-3

Diabetes Mellitus

Drug Therapy: Insulin

- **Types of insulin**
 - **Rapid-acting: Lispro**
 - ***Short-acting: Regular**
 - ***Intermediate-acting: NPH or Lente**
 - **Long-acting: Ultralente, Lantus**

Diabetes Mellitus

Drug Therapy: Insulin

- **Insulin**
 - **Cannot be taken orally**
 - **Self-administered by SQ injection**

Injection Sites

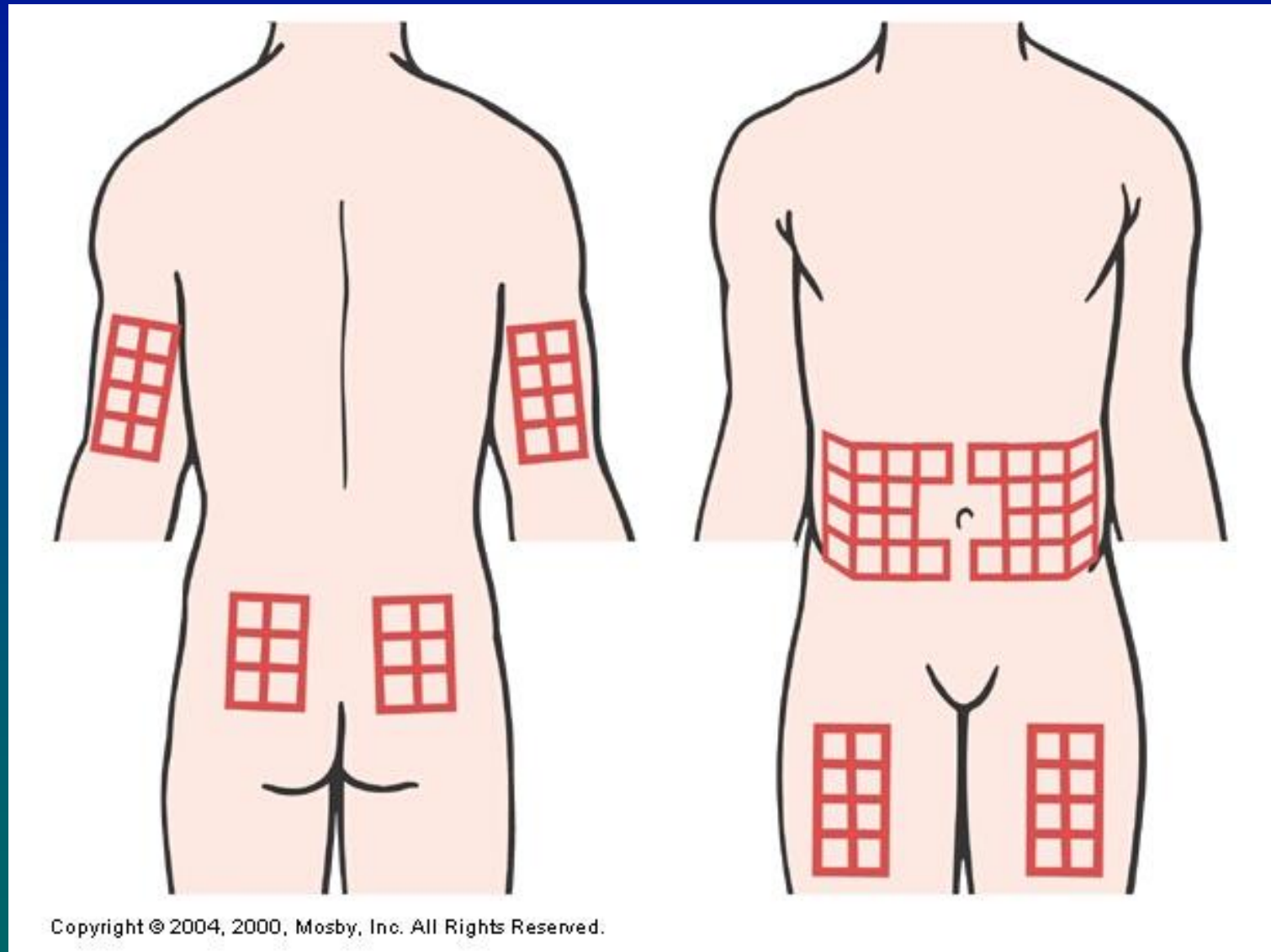


Fig. 47-5

Diabetes Mellitus

Drug Therapy: Insulin

- **Insulin delivery methods**
 - **Ordinary SQ injection**
 - **Insulin pen**
 - **preloaded with insulin; “dial” the dose**
 - **Insulin pump**
 - **Continuous “basal” infusion. At mealtime, user programs to deliver “bolus” infusion that correlates with amount of CHOs ingested. Allows tight control and greater flexibility with meals and activity**

Diabetes Mellitus

Drug Therapy: Insulin

- **Insulin delivery methods**
 - **Intensive insulin therapy**
 - **Multiple daily injects and frequent SMBG**

Diabetes Mellitus

Drug Therapy: Insulin

- **Problems with insulin therapy**
 - **Hypoglycemia (BS < 3.9 mmol/L)**
 - **Due to too much insulin in relation to glucose availability**

Diabetes Mellitus

Drug Therapy: Insulin

- **Problems with insulin therapy**
 - **Hypoglycemia**
 - **Allergic reactions**
 - **Local inflammatory reaction**
 - **Lipodystrophy**
 - **Hypertrophy or atrophy of SQ tissue r/t frequent use of same injection site. Less common now b/c pork and beef insulin infrequently used**

Diabetes Mellitus

Drug Therapy: Insulin

- **Problems with insulin therapy**
 - **Somogyi effect**
 - **Due to too much insulin**
 - **Early morning hypoglycemia followed by hyperglycemia (d/t stimulation of counter-regulatory hormones)**
 - **Dawn Phenomenon**
 - **Hyperglycemia secondary to nighttime release of growth hormone (a counter-regulatory hormone) that cause \uparrow BS in early am (5 – 6 am).**
 - **Rx with insulin that will peak at that time (intermediate at 10 pm)**

Diabetes Mellitus

Drug Therapy: Oral Agents

- **Not insulin**
- **Work to improve the mechanisms in which insulin and glucose are produced and used by the body**

Diabetes Mellitus

Drug Therapy: Oral Agents

- **Increase insulin production by pancreas**
- **Reduce glucose production by liver**
- **Enhance insulin sensitivity and glucose transport into cell**
- **Slow absorption of carbohydrate in intestine**

Diabetes Mellitus

Nutritional Therapy

- **Within the context of an overall healthy eating plan, a person with diabetes can eat the same foods as a person without diabetes**
- **Overall goal of nutritional therapy**
 - **Assist people to make changes in nutrition and exercise habits that will lead to improved metabolic control**

Diabetes Mellitus

Nutritional Therapy

- **Type 1 DM**
 - **Diet based on usual food intake, balanced with insulin and exercise patterns**
- **Type 2 DM**
 - **Emphasis placed on achieving glucose, lipid, and blood pressure goals**
 - **Calorie reduction**

Diabetes Mellitus

Nutritional Therapy

- **Food composition**
 - **Meal plan developed with dietitian**
 - **Nutritionally balanced**
 - **Does not prohibit the consumption of any one type of food**

Diabetes Mellitus

Nutritional Therapy

- **Alcohol**
 - **High in calories**
 - **Promotes hypertriglyceridemia**
 - **Can cause severe hypoglycemia b/c inhibits glucose production by liver**

Diabetes Mellitus

Nutritional Therapy

- **Exercise**
 - **Essential part of diabetes management**
 - **Increases insulin sensitivity**
 - **Lowers blood glucose levels**
 - **Decreases insulin resistance**

Diabetes Mellitus

Nutritional Therapy

- **Exercise**

- **Take small carbohydrate snacks Q 30 min during exercise to prevent hypoglycemia**
- **Exercise after meals**
- **Exercise plans should be individualized**
- **Monitor blood glucose levels before, during, and after exercise**

Diabetes Mellitus

Monitoring Blood Glucose

- **Self-monitoring of blood glucose (SMBG)**
 - **Allows self-management decisions regarding diet, exercise, and medication**
 - **Important for detecting episodic hyperglycemia and hypoglycemia**
 - **Patient education is crucial**

Diabetes Mellitus

Pancreas Transplantation

- **Used for patients with type 1 DM who have end-stage renal disease and who have had or plan to have a kidney transplant**
- **Eliminates the need for exogenous insulin**
- **Can also eliminate hypoglycemia and hyperglycemia**

Diabetes Mellitus

Nursing Management

Nursing Diagnoses

- **See NCP, pp. 1286-1287**
- **Ineffective therapeutic regimen management**
- **Fatigue**
- **Risk for infection**
- **Powerlessness**

Diabetes Mellitus

Nursing Management: Planning

- **Overall goals:**
 - **Active patient participation**
 - **No episodes of acute hyperglycemic emergencies or hypoglycemia**
 - **Maintain normal blood glucose levels**
 - **Prevent chronic complications**
 - **Lifestyle adjustment with minimal stress**

Diabetes Mellitus

Nursing Management

Nursing Implementation

- **Health Promotion**
 - **Identify those at risk**
 - **Routine screening for overweight adults over age 45**
 - **Diabetes prevention (weight control)**

Diabetes Mellitus

Nursing Management

Nursing Implementation

- **Ambulatory and Home Care**
 - **Insulin therapy and oral agents**
 - **Personal hygiene**
 - **Medical identification and travel**
 - **Patient and family teaching**

Diabetes Mellitus

Nursing Management

- **Stress Management**
 - **Emotional and physiological stress increase BG → hyperglycemia**
 - **Often need more insulin to maintain control (Type II diabetics normally controlled by OA may temporarily need insulin)**

Diabetes Mellitus

Nursing Management

- **Stress Management**
 - **When ill**
 - **Continue regular diet and ↑ intake of non-caloric fluids**
 - **Take insulin/OA as prescribed and check BG Q4h**
 - **If BG > 13.3 mmol/L, check urine for ketones and report moderate to high ketone levels**

Diabetes Mellitus

Nursing Management

- **Stress Management**
 - **When ill and unable to eat usual intake:**
 - **Continue insulin/OA (likely to be hyperglycemic even if not eating)**
 - **Supplement food with CHO-containing food**
 - **Closely monitor BG levels**

Diabetes Mellitus

Nursing Management

Nursing Implementation

- **Acute Complications**
 - **Hypoglycemia**
 - **Diabetic ketoacidosis**
 - **Hyperosmolar hyperglycemic nonketotic syndrome**

Diabetes Mellitus

Acute Complication : Hypoglycemia

- **Hypoglycemia**
 - Too much insulin (or oral agents) in relation to glucose availability
 - Usually coincides with peak action of insulin/OA
- **Brain requires constant glucose supply thus hypoglycemia affects mental function**

Diabetes Mellitus

Acute Complication : Hypoglycemia

- **S/S hypoglycemia**
 - **S/S of brain glucose deprivation (CNS symptoms)**
 - **Confusion, irritability**
 - **S/S of SNS stimulation (anxiety, tachycardia, tremors)**
 - **Diaphoreses, tremor, hunger, weakness, visual disturbances**
 - **If untreated → LOC, seizures, coma, death**
- **Hypoglycemic unawareness**
 - **autonomic neuropathy interferes with counter-regulatory hormones**
 - **Patients on β -blockers**

Diabetes Mellitus

Acute Complication : Hypoglycemia

- **Treatment for hypoglycemia**
 - **Ingest simple CHO (fruit juice, soft drink), or commercial gel or tablet**
 - **Avoid sweets with fat (slows sugar absorption)**
 - **Repeat Q15min until < 3.9 mmol/L**
 - **Then eat usual meal snack or meal and recheck**

Diabetes Mellitus

Acute Complication : Hypoglycemia

- **Treatment for hypoglycemia if not alert enough to swallow**
 - **Glucagon 1m IM or SQ (glycogen → glucose)**
 - **Then complex CHO when alert**

Diabetes Mellitus

Acute Complication : DKA

- **Diabetic Ketoacidosis (DKA): BG > 20 – 30 mmol/L**
 - Usually in Type 1 diabetes; can occur in Type 2
 - Causes:
 - Infection**
 - Stressors (physiological, psychological)
 - Stopping insulin
 - Undiagnosed diabetes

Diabetes Mellitus

Acute Complication: DKA

- **Pathophysiology**
 - Continuation of effects of insulin deficiency
 - Severe metabolic acidosis
 - Severe dehydration → shock
 - Severe electrolyte imbalance (↓ Na, ↓ K, ↓ Cl, ↓ Mg, ↓ PO4)
- **Clinical Manifestations**
 - S/S dehydration (↑ HR; ↓ BP, poor turgor, dry MM),
 - Kussmauls breathing (d/t metabolic acidosis)
 - Fruity breath (d/t acetone)
 - Abdominal pain, N & V, cardiac dysrhythmias

Diabetes Mellitus

Acute Complication: DKA

- **Treatment**
 - **Replace fluid and electrolytes**
 - **Insulin (First IV bolus, then infusion)**
 - **ID and correct precipitating cause (e.g., infection, etc.)**
 - **Teaching re: diabetes control**

Diabetes Mellitus

Acute Complication: HHNS

- **BG > 44.5 mmol/L**
- **Occurs in Type II diabetics (often elderly)**
- **Causes: similar to DKA**
- **Pathophysiology**
 - **Similar to DKA, except there is enough insulin to prevent ketosis (fat breakdown), but not enough to prevent hyperglycemia**
 - **Extreme hyperglycemia causes intracellular dehydration d/t movement of water from cells**

Diabetes Mellitus

Acute Complication: HHNS

- Clinical manifestation dehydration, weakness, polyuria, polydipsia, somnolence, seizures, coma
 - Treatment
 - Re-hydrate
 - Insulin IV
 - Monitor closely

Diabetes Mellitus

Chronic Complications

- **Angiopathy**
 - **Macrovascular**
 - **Microvascular**
- **Retinopathy**
- **Nephropathy**

Diabetes Mellitus

Chronic Complications

- **Neuropathy**
- **Skin problems**
- **Infection**

Diabetes Mellitus

Chronic Complications

- **Angiopathy – blood vessel disease**
 - **Macrovascular**
 - **Disease of large and mid-sized vessels**
 - **Related to altered lipid metabolism of diabetes**
 - **PVD**
 - **Cerebrovascular**
 - **Cardiovascular**
 - **Microvascular**
 - **Due to thickening of small vessel membranes**

Diabetes Mellitus

Chronic Complications

➤ Microvascular

➤ Retinopathy

- Leading cause of new blindness**
- Vessel occlusion → aneurysms → leakage of fluid**
- Vessel occlusion → new vessel growth → hemorrhage, retinal detachment**

Diabetes Mellitus

Chronic Complications

➤ Microvascular

➤ Nephropathy

- Damage to vessels supplying glomeruli
- Leading cause of ESRD

Diabetes Mellitus

Chronic Complications

- Microvascular
 - **Neuropathy**
 - **Sensory Neuropathy**
 - **Loss of sensation, abnormal sensation, pain of hands and/or feet**
 - **Can progress to partial or complete loss of sensitivity to touch and temperature → high risk of injury without pain**
 - **Rx is glucose control**

Diabetes Mellitus

Chronic Complications

- Microvascular
 - **Neuropathy**
 - **Autonomic neuropathy. Examples:**
 - **Hypoglycemic unawareness**
 - **Silent MI**
 - **Erectile dysfunction, decreased libido**
 - **Neurogenic bladder → urine retention**

Diabetes Mellitus

Chronic Complications

- **Diabetic Foot**
 - **Macrovascular disease → PVD (↓ supply of oxygen, WBCs, nutrients)**
 - **Sensory neuropathy → injury**
 - **Teach prevention of ulceration/injury**
 - **See Table 47-21**

Diabetes Mellitus

Chronic Complications

- Infection
 - Immune deficiencies
 - Delayed detection d/t sensory neuropathy
 - Decreased circulation – delays or prevents immune response