Objective #1 Explain factors that promote the normal reg. of BG in health

**Normal insulin metabolism**

- Produced by the β cells
  - Islets of Langerhans
- Released continuously into bloodstream in small increments with larger amounts released after food intake
- Stabilizes glucose range to 70 to 120 mg/dl
- Average daily secretion 0.6 units/kg body weight
**BG Homeostasis**

- **High Blood Glucose**
  - Pancreas releases insulin
  - Cells take up Glucose from Blood
  - Blood Glucose Falls

- **Low Blood Glucose**
  - Pancreas releases glucagon
  - Liver breaks down glycogen
  - Liver produces glycogen from Blood
  - Blood Glucose Rises

**Glucose Regulation**

- **Insulin**
  - Decreases glucose in the bloodstream
  - Insulin ↑ after a meal
  - Stimulates storage of glucose as glycogen in liver and muscle
  - Inhibits gluconeogenesis
  - Enhances fat deposition
  - ↑ Protein synthesis
  - Promotes glucose transport from bloodstream across cell membrane to cytoplasm of cell

**Glucose Regulation**

- **Stress**
  - Emotional and physical can increase BG levels
- **Medications**
  - Can potentiate hypo/hyper glycemic effects
- **Exercise**
- **Counterregulatory hormones**
  - Oppose effects of insulin
  - Increase blood glucose levels
  - Provide a regulated release of glucose for energy
  - Help maintain normal blood glucose levels
  - Examples
    - Glucagon, epinephrine, growth hormone, cortisol

*Obj#2 factors that influence glucose regulation*
Diabetes Mellitus

- A chronic multisystem disease related to
  - Abnormal insulin production
  - Impaired insulin utilization
  - Or both

Diabetes Mellitus

- Leading cause of
  - End-stage renal disease
  - Adult blindness
  - Nontraumatic lower limb amputations
- Major contributing factor
  - Heart disease
  - Stroke

Diabetes Mellitus

- 73% of adults with diabetes have hypertension
- 20.8 million people with diabetes in the US
- 41 million people with prediabetes
Diabetes Mellitus  
*Etiology and Pathophysiology*

- Two most common types
  - Type 1
  - Type 2
- Other types
  - Gestational
  - Prediabetes
  - Secondary diabetes

**Type 1 (Immune-mediated) 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**

- End result of long-standing process
  - Progressive destruction of pancreatic β cells by body’s own T 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
  – Theories link cause to single/ combination of these factors
  – Genetic
  – Autoimmune
  – Viral
  – Environmental

Onset of Disease

• Long preclinical period
• Antibodies present for months to years before symptoms occur
• Manifestations develop when pancreas can no longer produce insulin
  – Rapid onset of symptom
  – Will require exogenous insulin to sustain life

Clinical Manifestation

• History of recent, sudden, weight loss
• Classic symptoms
  – Polydipsia
  – Polyuria
  – Polyphagia
• Weight loss
• Weakness
• Fatigue
Clinical Manifestation
Type 1
Lack of insulin results in:
- Glucose molecules accumulate = hyperglycemia
  - which causes hyperosmolality (drawing H2O from the intracellular spaces into circulation)
  - The increased blood vol. increases renal blood flow
    - Acting as an osmotic diuretic
      » INCREASES URINE OUTPUT = POLYURIA

Clinical Manifestation type 1 continued...
- When the BG level exceeds the renal threshold for glucose: (about 180mg/dL)
  - Glucose is excreted in the urine - glucosuria
- The decrease in intracellular vol. & the increased urinary output cause dehydration
  - Thirst sensors are activated causing pt to drink increased amts of fluid = POLYDIPSIA

Clinical Manifestation type 1 continued
- Because glucose cannot enter the cell without insulin, energy production decreases
  - Stimulates hunger
  - Person wants/eats more food = POLYPHAGIA
Clinical Manifestations continued

- Weight loss
  - acute - loss of H2O, glycogen, triglyceride stores
  - chronic - muscle mass
- Blurred vision
  - effect of hyperosmolar fluid on lenses & retina
- Fatigue, Malaise & Dizziness
  - fluid volume & K+, postural hypotension,
  - protein catabolism

Type 2 Diabetes Mellitus

- Most prevalent type of diabetes
- Over 90% of patients with diabetes
- Usually occurs in people over 35 years of age
- 80% to 90% of patients are overweight

Type 2 Diabetes

- Prevalence increases with age
- Genetic basis
- Greater in some ethnic populations
  - Increased rate in African Americans, Asian Americans, Hispanic Americans, and Native Americans
  - Native Americans and Alaskan Natives: Highest rate of diabetes in the world
Type 2 Diabetes Mellitus

Etiology and Pathophysiology

- Pancreas continues to produce some endogenous insulin
- Insulin produced is either insufficient or poorly utilized by tissues

Type 2 Diabetes Mellitus

Etiology and Pathophysiology

- Obesity (abdominal/visceral)
  - Most powerful risk factor
- Genetic mutations
  - Lead to insulin resistance
  - Increased risk for obesity
  - http://cosmos.bcst.yahoo.com/up/player/popper?cl=7492540

Type 2 Diabetes

Etiology and Pathophysiology

Major metabolic abnormalities

1. Insulin resistance
   - Body tissues do not respond to insulin
     - Insulin receptors either unresponsive or insufficient in number
     - Results in hyperglycemia
2. Pancreas ↓ ability to produce insulin
   - β cells fatigued from compensating
     - β-cell mass lost
3. Inappropriate glucose production from liver
   - Liver’s response of regulating release of glucose is haphazard
   - Not considered a primary factor in development of type 2
Type 2 Diabetes
Etiology and Pathophysiology

- Individuals with metabolic syndrome ("Syndrome X") are at increased risk for type 2:
  - Cluster of abnormalities that increase risk for cardiovascular disease and diabetes
    - Elevated insulin levels, ↑ triglycerides & LDLs, ↓ HDLs, hypertension
  - Risk factors
    - Central obesity, sedentary lifestyle, urbanization, certain ethnicities

Type 2 Diabetes Mellitus
Onset of Disease

- Gradual onset
- Person may go many years with undetected hyperglycemia
- Osmotic fluid/electrolyte loss from hyperglycemia may become severe
  - Hyperosmolar coma

Clinical Manifestations
Type 2 Diabetes Mellitus

- Nonspecific symptoms
  - May have classic symptoms of type 1
- Fatigue
- Recurrent infections
- Recurrent vaginal yeast infections (Candida)
- Prolonged wound healing
- Visual changes
Prediabetes

- Known as impaired glucose tolerance (IGT) or impaired fasting glucose (IFG)
- IGT: Fasting glucose levels higher than normal (>100 mg/dl, but <126 mg/dl)
- IFG: 2-hour plasma glucose higher than normal (between 140 and 199 mg/dl)

Prediabetes

- Not high enough for diabetes diagnosis
- Increase risk for developing type 2 diabetes
- If no preventive measure taken—usually develop diabetes within 10 years
- Long-term damage already occurring
  - Heart, blood vessels
- Usually present with no symptoms
- Must watch for diabetes symptoms
  - Polyuria
  - Polyphagia
  - Polydipsia

Gestational Diabetes

- Develops during pregnancy
- Detected at 24 to 28 weeks of gestation
- Usually glucose levels back to normal at 6 weeks postpartum
- Increased risk for cesarean delivery, perinatal death, and neonatal complications
- Increased risk for developing type 2 in 5 to 10 years
- Therapy: First nutritional, second insulin
Diabetes Mellitus

Diagnostic Studies

• Three methods of diagnosis
  – Fasting plasma glucose level >126 mg/dl
  – Random or casual plasma glucose measurement ≥ 200 mg/dl plus symptoms
  – Two-hour OGTT level ≥ 200 mg/dl using a glucose load of 75g-100 g

• Hemoglobin A1C test (also called glycosylated hemoglobin)
  – Useful in determining glycemic levels over time
  – Not diagnostic but monitors success of treatment
  – Shows the amount of glucose attached to hemoglobin molecules over RBC life span
    • 90 to 120 days
    • Ideal goal
      • ADA ≤ 7.0%
      • American College of Endocrinology < 6.5%
  – Normal A1C reduces risk of retinopathy, nephropathy, and neuropathy

Diabetes Mellitus

Chronic Complications

• Angiopathy
  – Macrovascular
    • Diseases of large and medium-sized blood vessels
      – Heart, Cerebral vascular, Peripheral vascular
    • Patients with diabetes should be screened for dyslipidemia at diagnosis
    • Tight glucose control may delay atherosclerotic process
    • Risk factors
Diabetes

Chronic Complications

• Angiopathy (cont’d)
  – **Microvascular**
    • Result from thickening of vessel membranes in capillaries and arterioles
    – In response to chronic hyperglycemia
    • Is specific to diabetes unlike macrovascular
  – Areas most noticeably affected
    • Eyes (retinopathy)
    • Kidneys (nephropathy)
    • Skin (dermopathy)
  – Clinical manifestations usually appear after 10 to 20 years of diabetes

Diabetes

Chronic Complications

• Diabetic retinopathy
  – Microvascular damage to retina
  – Most common cause of new cases of blindness in people 20 to 74 years
  – Must have annual dilated eye examinations

Diabetes

Chronic Complications

• Diabetic retinopathy (cont’d)
  – Nonproliferative
    • Most common form
    • Partial occlusion of small blood vessels in retina
      – Causes development of microaneurysms
      – Capillary fluid leaks out
        » Retinal edema and eventually hard exudates or intraretinal hemorrhages occur
Diabetes
Chronic Complications

- Diabetic retinopathy (cont’d)
  - Proliferative
    - Most severe form
    - Involves retina and vitreous
    - When retinal capillaries become occluded
      - Body forms new blood vessels
      - Vessels are extremely fragile and hemorrhage easily
        - Produce vitreous contraction
      - Retinal detachment can occur

- Diabetic nephropathy
  - Associated with damage to small blood vessels that supply the glomeruli of the kidney
  - Leading cause of end-stage renal disease
  - Yearly screening
    - Microalbuminuria in urine
    - Serum creatinine
  - Critical factors for prevention/delay
    - Tight glucose control
    - Blood pressure management
      - Angiotensin-converting enzyme (ACE) inhibitors
        - Used even when not hypertensive

- Diabetic neuropathy
  - 60% to 70% of patients with diabetes have some degree of neuropathy
  - Nerve damage due to metabolic derangements of diabetes
  - Sensory versus autonomic neuropathy
Diabetes

Chronic Complications

• Diabetic neuropathy (cont’d)
  – Sensory
  • Treatment
    – Tight blood glucose control
    – Drug therapy
      » Topical creams
      » Tricyclic antidepressants
      » Selective serotonin and norepinephrine reuptake inhibitors
      » Antiseizure medications

• Diabetic neuropathy (cont’d)
  – Sensory neuropathy
  • Distal symmetric
    – Most common form
    – Affects hands and/or feet bilaterally
    – Characteristics include
      » Loss of sensation, abnormal sensations, pain, and paresthesias

• Diabetic neuropathy (cont’d)
  – Sensory
    • Usually worse at night
    • Foot injury and ulcerations can occur without the patient having pain
    • Can cause atrophy of small muscles of hands/feet
Diabetes
Chronic Complications

• Diabetic neuropathy (cont’d)
  – Autonomic
    • Can affect nearly all body systems
  – Complications
    – Gastroparesis
      » Delayed gastric emptying
    – Cardiovascular abnormalities
    – Sexual function
    – Neurogenic bladder

• Complications of foot and lower extremity
  – Foot complications
    • Most common cause of hospitalization in diabetes
    • Result from combination of microvascular and macrovascular diseases
  – Risk factors
    • Sensory neuropathy
    • Peripheral arterial disease
  – Other contributors
    • Smoking
    • Clotting abnormalities
    • Impaired immune function
    • Autonomic neuropathy

• Integumentary complications
  – Acanthosis nigricans
    • Dark, coarse, thickened skin
  – Necrobiosis lipoidica diabetorum
    • Associated with type 1
    • Red-yellow lesions
    • Skin becomes shiny, revealing tiny blood vessels
  – Granuloma annulare
    • Associated mainly with type 1
    • Forms partial rings of papules
Diabetes

**Chronic Complications**

- Infection
  - Diabetics more susceptible to infections
  - Defect in mobilization of inflammatory cells
  - Loss of sensation may delay detection
  - Treatment must be prompt and vigorous

**Acute Complications**

- Diabetic ketoacidosis (DKA)
- Hyperosmolar hyperglycemic syndrome (HHS)
- Hypoglycemia

**DKA**

- Caused by profound deficiency of insulin
- Characterized by
  - Hyperglycemia
  - Ketosis
  - Acidosis
  - Dehydration
- Most likely occurs in type 1 diabetic
- Occurs in absence of exogenous insulin
- Life-threatening condition
- Results in metabolic acidosis
Diabetes

Acute Complications

• DKA (cont’d)
  – When supply of insulin insufficient
    • Glucose cannot be properly used for energy
    • Body breaks down fats stores
      – Ketones are by-products of fat metabolism
  – Precipitating factors
    • Illness
    • Infection
    • Inadequate insulin dosage
    • Undiagnosed type 1
    • Poor self-management
    • Neglect

• Signs and symptoms
  • Lethargy/weakness (early sympt), dehydration
  • Abdominal pain
  • N/V
  • Kussmaul respirations
    – Rapid deep breathing
    – Attempt to reverse metabolic acidosis
    – Sweet fruity odor
  – Serious condition
    • Must be treated promptly
  – Depending on signs/symptoms
    • May or may not need hospitalization

• Laboratory findings
  – Blood glucose > 300 mg/dl
  – Arterial blood pH below 7.30
  – Serum bicarbonate level <15 mEq/L
  – Ketones in blood and urine
  – Correct fluid/electrolyte imbalance
    • IV infusion 0.45% or 0.9% NaCl
    • When blood glucose levels approach 250 mg/dl
      – 5% dextrose added to regimen
      – Prevent hypoglycemia
    • Potassium replacement
    • Sodium bicarbonate
      – If pH <7
Diabetes

Acute Complications

• DKA (cont’d)
  – Airway management
    • O2 administration
  – Insulin therapy
    • Withheld until fluid resuscitation has begun
    • Bolus followed by insulin drip

• Hyperosmolar hyperglycemic syndrome (HHS)
  – Life-threatening syndrome
  – Less common than DKA
  – Often occurs in patients over 60 years with type 2
  – Patient has enough circulating insulin so ketoacidosis does not occur
  – Produces fewer symptoms in earlier stages
  – Neurologic manifestations occur due to ↑ serum osmolality

• HHS (cont’d)
  – Usually history of
    • Inadequate fluid intake
    • Increasing mental depression
    • Polyuria
  – Laboratory values
    • Blood glucose >400 mg/dl
    • Increase in serum osmolality
    • Absent/minimal ketone bodie
  – Therapy similar to DKA
    • Except HHS requires greater fluid replacement
Diabetes
Acute Complications

• Nursing management DKA/HHS
  – Patient closely monitored
    • Administration
      – IV fluids
      – Insulin therapy
      – Electrolytes
    • Signs potassium imbalance
    • Cardiac monitoring
    • Vital signs
    • Level of consciousness

Diabetes
Acute Complications

• Hypoglycemia
  – Low blood glucose
  – Occurs when
    • Too much insulin in proportion to glucose in the blood
    • Blood glucose level less than 70 mg/dl
  – Common manifestations
    • Confusion
    • Irritability
    • Diaphoresis
    • Tremors
    • Hunger

Diabetes
Acute Complications

• Hypoglycemia (cont’d)
  – Common manifestations
    • Weakness
    • Visual disturbances
    • Can mimic alcohol intoxication
  – Untreated can progress to loss of consciousness, seizures, coma, and death
Diabetes
*Acute Complications*

• Hypoglycemia (cont’d)
  – Hypoglycemic unawareness
    • Person does not experience warning
      signs/symptoms, increasing risk for decreased
      blood glucose levels
      – Related to autonomic neuropathy
    – Causes
      • Mismatch in timing
        – Food intake and peak action of insulin or oral
          hypoglycemic agents

  – At the first sign
    • Check blood glucose
      – If <70 mg/dl, begin treatment
      – If >70 mg/dl, investigate further for cause of
        signs/symptoms
      – If monitoring equipment not available, treatment should
        be initiated

  – Treatment
    • If alert enough to swallow
      – 15 to 20 g of a simple carbohydrate
        » 4 to 6 oz fruit juice
        » Regular soft drink
      – Avoid foods with fat
        » Decrease absorption of sugar
        – Do not overtreat
      – Recheck blood sugar 15 minutes after treatment
      – Repeat until blood sugar >70 mg/dl
      – Patient should eat regularly scheduled meal/snack to
        prevent rebound hypoglycemia
      – Check blood sugar again 45 minutes after treatment

Diabetes

Acute Complications

• Hypoglycemia (cont’d)
  – Treatment
    • If no improvement after 2 or 3 doses of simple carbohydrate or pt not alert enough to swallow
    • Administer 1 mg of glucagon IM or subcutaneously
    – Side effect: Rebound hypoglycemia
    • Have patient ingest a complex carbohydrate after recovery
    • In acute care settings
      – 20 to 50 ml of 50% dextrose IV push

Nursing Management

Nursing Assessment

• Past health history
  – Viral infections
  – Medications
  – Recent surgery
• Positive health history
• Obesity

• Weight loss
• Thirst
• Hunger
• Poor healing
• Kussmaul respirations
Nursing Management

Nursing Diagnoses
- Ineffective therapeutic regimen management
- Risk for injury
- Risk for infection
- Powerlessness
- Imbalanced nutrition: More than body requirements
- Fluid volume deficit
- Tissue perfusion, altered
- Altered sexuality patterns

Nursing Management

Planning
- Overall goals
  - Active patient participation
  - Few or no episodes of acute hyperglycemic emergencies or hypoglycemia
  - Maintain normal blood glucose levels
  - Prevent or delay chronic complications
  - Lifestyle adjustments with minimal stress

Nursing Management

Nursing Implementation
- Health promotion
  - Identify those at risk
  - Routine screening for overweight adults over age 45
    - FPG is preferred method in clinical settings
Nursing Management

Nursing Implementation

• Acute intervention
  – Hypoglycemia
  – Diabetic ketoacidosis
  – Hyperosmolar hyperglycemic nonketotic syndrome

Nursing Management

Nursing Implementation

• Acute intervention (cont’d)
  – Stress of illness and surgery
    • ↑ Blood glucose level
    • Continue regular meal plan
    • ↑ Intake of noncaloric fluids
    • Continue taking oral agents and insulin
    • Frequent monitoring of blood glucose
      – Ketone testing if glucose > 240 mg/dl

Nursing Management

Nursing Implementation

• Acute intervention (cont’d)
  – Stress of illness and surgery
    • Patients undergoing surgery or radiologic procedures requiring contrast medium should hold their metformin day of surgery and 48 hours
      – Begun after serum creatinine has been checked and is normal
Nursing Management
Nursing Implementation

• Ambulatory and home care
  – Overall goal is to enable patient or caregiver
to reach an optimal level of independence
  – Insulin therapy and oral agents
  – Personal hygiene

Nursing Management
Nursing Implementation

• Ambulatory and home care (cont’d)
  – Insulin therapy and oral agent
    • Education on proper administration, adjustment and side
effects
    • Assessment of patient’s response to therapy
  – Personal hygiene
    • Regular bathing with emphasis on foot care
    • Daily brushing/flossing
      – Dentist should be informed about diabetes diagnosis

Nursing Management
Nursing Implementation

• Ambulatory and home care (cont’d)
  – Medical identification and travel card
    • Must carry identification indicating diagnosis of diabetes
  – Patient and family teaching
    • Educate on disease process, physical activity, medications,
monitoring blood glucose, diet, resources
    • Enable patient to become most active participant in his/her
care
Nursing Management

Evaluation

• Knowledge
• Balance of nutrition
• Health benefits
• No injuries

Diabetes Mellitus

Collaborative Care

• Goals of diabetes management
  – Decrease symptoms
  – Promote well-being
  – Prevent acute complications
  – Delay onset and progression of long-term complications

Drug Therapy

Insulin

• Exogenous insulin
  – Insulin from an outside source
  – Required for type 1 diabetes
  – Prescribed for patient with type 2 diabetes who cannot control blood glucose by other means

• Types of insulin
  – Human insulin
    • Only type used today
    • Prepared through genetic engineering
Drug Therapy

Insulin

- Regimen that closely mimics endogenous insulin production is basal-bolus
  - Long-acting (basal) once a day
  - Rapid/short-acting (bolus) before meals

Insulin preparations

- Rapid-acting (bolus) Lispro, aspart, glulisine
  - Onset 0 to 15 minutes
  - Peak 60-90 min
  - Duration 3-4 hours

- Short-acting (bolus) Regular
  - Onset 30 to 60 minutes
  - Peak 2-3 hours
  - Duration 3-6 hours

- Intermediate Acting NPH or Lente
  - Cloudy
  - Vial must be rolled or rocked a min of 20 times
  - Onset 2-4 hours
  - Peak 4-10
  - Duration 10-16

- Long-acting (basal) glargine (Lantus), detemir (Levemir)
  - Injected once a day at bedtime or in the morning
  - Onset 1-2 hours
  - Duration 24+ hours
  - No peak action-released steadily and continuously
  - Cannot be mixed with any other insulin or solution
Drug Therapy

Insulin

- Storage of insulin
  - Do not heat/freeze
  - In-use vials may be left at room temperature up to 4 weeks
  - Extra insulin should be refrigerated
  - Avoid exposure to direct sunlight
- Administration of insulin
  - Cannot be taken orally
  - Subcutaneous injection for self-administration
  - IV administration

Drug Therapy

Insulin

- Administration of insulin (cont’d)
  - Fastest absorption from abdomen, followed by arm, thigh, buttck
  - Abdomen
    - Preferred site
  - Rotate injections within one particular site
  - Do not inject in site to be exercised

Drug Therapy

Insulin

- Administration of insulin (cont’d)
  - Do not inject in site to be exercised
  - Usually available as U100
    - 1 ml contains 100 units of insulin
  - No alcohol swab on site needed before injection
  - washing with soap and rinsing with water is adequate
  - Do not recap needle
  - 45- to 90-degree angle depending on fat thickness of patient
  - Insulin pens preloaded with insulin now available
Drug Therapy

**Insulin**

- Insulin pump
  - Continuous subcutaneous infusion
  - Battery operated device
  - Connected via plastic tubing to a catheter inserted into subcutaneous tissue in abdominal wall
  - Potential for tight glucose control

**Inhaled Insulin**

- Exubera
  - Rapid-acting, dry powder inhaled through mouth into lungs
  - Not recommended for patients with asthma, bronchitis, or emphysema

**Problems with insulin therapy**

- Hypoglycemia
- Allergic reactions
- Lipodystrophy
- Somogyi effect
- Dawn phenomenon
Drug Therapy

**Insulin**

- Problems with insulin therapy
  - Somogyi effect
    - Rebound effect in which an overdose of insulin causes hypoglycemia
    - Usually during hours of sleep
    - Counterregulatory hormones released
      - Rebound hyperglycemia and ketosis occur

Drug Therapy

**Insulin**

- Problems with insulin therapy
  - Dawn phenomenon
    - Characterized by hyperglycemia present on awakening in the morning
      - Due to release of counterregulatory hormones in predawn hours
      - Growth hormone/cortisol possible factors

Drug Therapy

**Oral Agents**

- Not insulin
- Work to improve mechanisms by which insulin and glucose are produced and used by the body
- Work on three defects of type 2 diabetes
  - Insulin resistance
  - Decreased insulin production
  - Increased hepatic glucose production
Drug Therapy
Oral Agents

• Sulfonylureas
  – ↑ Insulin production from pancreas
  – ↓ Chance of prolonged hypoglycemia
  – 10% experience decreased effectiveness after prolonged use
  – Examples
    • Glipizide (Glucotrol)
    • Glimepiride (Amaryl)

• Meglitinides
  – Increase insulin production from pancreas
  – Taken 30 minutes before each meal up to time of meal
  – Should not be taken if meal skipped
  – Examples
    • Repaglinide (Prandin)
    • Nateglinide (Starlix)
Drug Therapy
Oral Agents

- Biguanides
  - Reduce glucose production by liver
  - Enhance insulin sensitivity at tissues
  - Improve glucose transport into cells
  - Does not promote weight gain
  - Example
    • Metformin (Glucophage)

Drug Therapy
Oral Agents

- α-Glucosidase inhibitors
  - “Starch blockers”
    • Slow down absorption of carbohydrate in small intestine
  - Example
    • Acarbose (Precose)

Drug Therapy
Oral Agents

- Thiazolidinediones
  - Most effective in those with insulin resistance
  - Improves insulin sensitivity, transport, and utilization at target tissues
  - Examples
    • Pioglitazone (Actos)
    • Rosiglitazone (Avandia)
Drug Therapy
Other Agents

• Amylin analog
  – Hormone secreted by \( \beta \) cells of pancreas
  – Co-secreted with insulin
  – Indicated for type 1 and type 2 diabetics
  – Administered subcutaneously
    • Thigh or abdomen
  – Slows gastric emptying, reduces postprandial glucagon secretion, increases satiety
  – Example
    • Pramlintide (Symlin)

Drug Therapy
Other Agents

• Incretin mimetic
  – Synthetic peptide
  – Stimulates release of insulin from \( \beta \) cells
  – Subcutaneous injection
  – Suppresses glucagon secretion
  – Reduces food intake
  – Slows gastric emptying
  – Not to be used with insulin
  – Example
    • Byetta

Drug Therapy
Other Agents

• \( \beta \)-Adrenergic blockers
  – Mask symptoms of hypoglycemia
  – Prolong hypoglycemic effects of insulin

• Thiazide/loop diuretics
  – Can potentiate hyperglycemia
    • By inducing potassium loss
Diabetes

Nutritional Therapy

- Cornerstone of care for person with diabetes
- Most challenging for many people
- Recommended that diabetes nurse educator and registered dietitian with diabetes experience be members of team

Diabetes

Nutritional Therapy

- American Diabetes Association (ADA)
  - Guidelines indicate that within context of an overall healthy eating plan, person with diabetes can eat same foods as person who does not have diabetes
  - Overall goal
    - Assist people in making changes in nutrition and exercise habits that will lead to improved metabolic control

Diabetes

Nutritional Therapy

- Type 1 diabetes mellitus
  - Meal plan based on individual’s usual food intake and is balanced with insulin and exercise patterns
  - Insulin regimen managed day to day
Diabetes

Nutritional Therapy

• Type 2 diabetes mellitus
  – Emphasis based on achieving glucose, lipid, and blood pressure goals
  – Calorie reduction

Diabetes

Nutritional Therapy

• Food composition
  – Nutrient balance of diabetic diet is essential
  – Nutritional energy intake should be balanced with energy output

Diabetes

Nutritional Therapy

• Carbohydrates
  – Carbohydrates and monounsaturated fats should provide 45% to 65% of total energy intake
  – Carbohydrate diets are not recommended for diabetics

• Glycemic index (GI)
  – Term used to describe rise in blood glucose levels after consuming carbohydrate-containing food
  – Should be considered when formulating a meal plan
Diabetes

Nutritional Therapy

• Fats
  – No more than 20% to 35% of meal plan’s total calories
    • <7% from saturated fats, minimal trans fat
• Protein
  – Contribute <10% of total energy consumed
  – Intake should be significantly less than general population

• Alcohol
  – High in calories
  – No nutritive value
  – Promotes hypertriglyceridemia
  – Detrimental effects on liver
  – Can cause severe hypoglycemia

• Diet teaching
  – Dietitian initially provides instruction
  – Should include patient’s family and significant others
  – USDA MyPyramid guide
    • An appropriate basic teaching tool
  – Plate method
    • Helps patient visualize the amount of vegetable, starch, and meat that should fill a 9-inch plate
Diabetes

Exercise

• Exercise
  – Essential part of diabetes management
  – ↑ Insulin receptor sites
  – Lowers blood glucose levels
  – Contributes to weight loss
  – Should be individualized
  – Monitor blood glucose levels before, during, and after exercise

Diabetes

Exercise

• Exercise (cont’d)
  – Several small carbohydrate snacks can be taken every 30 minutes during exercise to prevent hypoglycemia
  – Best done after meals
  – Exercise plans should be started
    • After medical clearance
    • Slowly with gradual progression

Monitoring Blood Glucose

• Self-monitoring of blood glucose (SMBG)
  – Enables patient to make self-management decisions regarding diet, exercise, and medication
Monitoring Blood Glucose

• Self-monitoring of blood glucose (SMBG) (cont’d)
  – Important for detecting episodic hyperglycemia and hypoglycemia
  – Patient training is crucial
  – Supplies immediate information about blood glucose levels

Diabetes

Pancreas Transplantation

• Pancreas transplants alone are rare
  – Usually kidney and pancreas transplants done together
• Eliminates need for exogenous insulin
• Can also eliminate hypoglycemia and hyperglycemia
• Used for patients with type 1 diabetes who also have
  – End-stage renal disease
  – Had, or plan to have, a kidney transplant

Diabetes

Perioperative Management

• Acute illness, injury, surgery
  – May evoke counterregulatory hormone response
    • Resulting in hyperglycemia
  – IV fluids and insulin given immediately before during and after surg when there is no oral intake
  – Surg or radiologic procedure that involve the use of a contrast medium
    • Hold metformin for procedure and 48hrs after
Diabetes
Sick Day Guidelines

• Monitor BG every 4 hours Call provider if >240mg/dl.
• Never omit medication or insulin
• Continue to take usual insulin dose or OHA
• Continue with regular meal plan
  – Substitute easily digested liquids or soft foods if solid not tolerated
• Call provider if unable to eat for more than 24hr or if vomiting/diarrhea last longer than 6hrs
• Test for ketones every 3-4 hours
  – Pt should report moderate to large ketone levels to provider
• Increase intake non caloric fluids such as broth water diet gelatin & other decaf beverages

Diabetes
Gerontologic Considerations

• Recognize limitations in physical activity, manual dexterity and visual acuity
• Education based on individual’s needs, using slower pace

Diabetes
Gerontologic Considerations

• Prevalence increases with age
• Hypoglycemia unawareness is more common
• Presence of delayed psychomotor function could interfere with treating hypoglycemia
• Must consider patient’s own desire for treatment and coexisting medical problems