Overview of Anatomy and Physiology

Heart

- Four-chambered, hollow, muscular organ, not much bigger than a fist
- Lies in the mediastinum
- Lower border is called the **apex**
- Heart wall: three layers
  - Epicardium: serous membrane on the outside of the heart
  - Myocardium: constructed of cardiac muscle
  - Endocardium: lines the inner surface of the chambers of the heart

Figure 48-1

Overview of Anatomy and Physiology

Heart chambers

- Right atrium—receives deoxygenated blood
- Left atrium—receives oxygenated blood
- Right ventricle—pumps deoxygenated blood
- Left ventricle—pumps oxygenated blood

Heart valves

- Atrioventricular valves
  - Tricuspid and bicuspid valves
- Semilunar valves
  - Pulmonary and aortic semilunar valves

Figure 48-2

Overview of Anatomy and Physiology

Electrical conduction system

- Automaticity
  - An inherent ability of the heart muscle tissue to contract in a rhythmic pattern
- Irritability
  - The ability to respond to a stimulus

- Impulse pattern
  - Sinoatrial node to AV node to bundle of His to right and left bundle branches to Purkinje fibers

- Figure 48-3

- Overview of Anatomy and Physiology

- Cardiac cycle
  - A complete heartbeat
    - Atria contract while ventricles relax
    - Ventricles contract while atria relax
  - Systole
    - Phase of contraction
  - Diastole
    - Phase of relaxation
    - Period between contraction of the atria or ventricles during which the blood enters the relaxed chambers

- Figure 48-4

- Figure 48-5

- Overview of Anatomy and Physiology

- Blood vessels
  - Capillaries
    - Tiny blood vessels joining arterioles and venules
  - Arteries
    - Large vessels carrying blood away from the heart
  - Veins
    - Vessels that convey blood from the capillaries to the heart
• Circulation

• Coronary blood supply
  ▪ Right and left coronary arteries
    • Branch off of the aorta
    • Encircle the heart like a crown
    • Supply the myocardium with blood
  ▪ Coronary veins
    • Return the unoxygenated blood to the coronary sinus, then to the right atrium

• Figure 48-6

• Circulation

• Systemic circulation
  ▪ Circulates blood from the left ventricle to all parts of the body and back to the right atrium
  ▪ Carries oxygen and nutritive materials to all body tissues and removes products of metabolism

• Pulmonary circulation
  ▪ Circulates blood from the right ventricle to the lungs and back to the left atrium of the heart
  ▪ Carries deoxygenated blood to the lungs to be reoxygenated and removes the metabolic waste product, carbon dioxide

• Laboratory and Diagnostic Examinations

• Diagnostic imaging
  ▪ Fluoroscopy
  ▪ Angiogram
  ▪ Aortogram

• Cardiac catheterization and angiography

• Electrocardiography
Cardiac monitors

Thallium scanning

Laboratory tests: CBC, blood cultures, coagulation studies, ESR electrolytes, lipids, arterial blood gases, cardiac markers

Figure 48-7

Disorders of the Cardiovascular System

Risk factors
  - Nonmodifiable factors
    - Family history
    - Age
    - Sex (gender)
    - Race

Disorders of the Cardiovascular System

Risk factors (continued)
  - Modifiable factors
    - Smoking
    - Hyperlipidemia
    - Hypertension
    - Diabetes mellitus
    - Obesity
    - Sedentary lifestyle
    - Stress
    - Oral contraceptives
    - Psychosocial factors

Disorders of the Cardiovascular System
Cardiac dysrhythmias

- Any cardiac rhythm that deviates from normal sinus rhythm
  - Sinus tachycardia
  - Sinus bradycardia
  - Supraventricular tachycardia
  - Atrial fibrillation
  - Atrioventricular block
  - Premature ventricular contractions
  - Ventricular tachycardia
  - Ventricular fibrillation

Disorders of the Cardiovascular System

Cardiac Arrest

- The sudden cessation of cardiac output and circulatory process
- Cause: ventricular tachycardia, ventricular fibrillation, and ventricular asystole
- Signs and symptoms: abrupt loss of consciousness with no response to stimuli; gasping respirations followed by apnea; absence of pulse and blood pressure; pupil dilation; pallor and cyanosis
- Treatment: cardiopulmonary resuscitation (CPR) and advanced cardiac life support (ACLS)

Disorders of the Heart

Coronary atherosclerotic heart disease

- Coronary artery disease (CAD)
  - A variety of conditions that obstruct blood flow in the coronary arteries
- Atherosclerosis
  - A common arterial disorder characterized by yellowish plaques of cholesterol, lipids, and cellular debris in the inner layers of the walls of the arteries; the primary cause of atherosclerotic heart disease (ASHD)

Figure 48-10
Disorders of the Heart

Angina pectoris

- Etiology/pathophysiology
  - Cardiac muscle is deprived of oxygen
  - Increased workload on the heart

- Clinical manifestations/assessment
  - Pain (usually relieved by rest)
  - Dyspnea
  - Anxiety; apprehension
  - Diaphoresis
  - Nausea

- Medical management/nursing interventions
  - Correct cardiovascular risk factors
  - Avoid precipitating factors
  - Pharmacological management
    - Dilate coronary arteries and decrease workload of heart
      - Nitroglycerin
      - Beta-adrenergic blocking agents
      - Calcium channel blockers

- Surgical interventions
  - Coronary artery bypass graft (CABG)
  - Percutaneous transluminal coronary angioplasty (PTCA)
  - Stent placement
Disorders of the Heart

Myocardial infarction

Etiology/pathophysiology

- Occlusion of a major coronary artery or one of its branches with subsequent necrosis of myocardium
- Most common cause is atherosclerosis
- Ability of the cardiac muscle to contract and pump blood is impaired

Clinical manifestations/assessment

- Asymptomatic (silent MI)
- Pain (not relieved by rest, position, or nitroglycerin)
- Nausea
- SOB; dizziness; weakness
- Diaphoresis
- Pallor—ashen color
- Sense of impending doom

Medical management/nursing interventions

- Oxygen
- Fibrinolytic agents
- Percutaneous transluminal coronary angioplasty (PTCA)
- Coronary artery bypass graft surgery
Pharmacological management
- Vasopressors, analgesics, nitrates, beta-adrenergic blockers, calcium channel blockers, antidysrhythmics, diuretics, inotropic agents, diuretics, stool softeners

- Figure 48-12
- Figure 48-13

Disorders of the Heart

Heart failure
- Etiology/pathophysiology
  - Abnormal condition characterized by circulatory congestion resulting from the heart’s inability to act as an effective pump
  - Left ventricular failure
    - Most common
  - Right ventricular failure
    - Usually caused by left ventricular failure

Disorders of the Heart

Heart failure (continued)
- Clinical manifestations/assessment
  - Decreased cardiac output
    - Fatigue
    - Angina
    - Anxiety; restlessness
    - Oliguria
    - Decreased GI motility
    - Pale, cool skin
    - Weight gain

Disorders of the Heart

Heart failure (continued)
- Clinical manifestations/assessment (continued)
  - Left ventricular failure
• Pulmonary congestion
  o Dyspnea
  o Paroxysmal nocturnal dyspnea
  o Cough; frothy, blood-tinged sputum
  o Orthopnea
  o Pulmonary crackles
  o Pleural effusion (x-ray)

• Disorders of the Heart

• Heart failure (continued)
  ▪ Clinical manifestations/assessment (continued)
    • Right ventricular failure
      ▪ Distended jugular veins
      ▪ Anorexia, nausea, and abdominal distention
      ▪ Liver enlargement
      ▪ Ascites
      ▪ Edema in feet, ankles, sacrum; may progress up the legs into thighs, external genitalia, and lower trunk

• Disorders of the Heart

• Heart failure (continued)
  ▪ Medical management/nursing interventions
    • Pharmacological management
      ▪ Increase cardiac efficiency
        o Digitalis
        o Vasodilators
        o ACE inhibitors (decrease blood pressure)
    • Bed rest, HOB elevated
    • Oxygen
    • Treat edema and pulmonary congestion
    • Monitor fluid retention (weigh daily; strict I&O)

• Disorders of the Heart

• Pulmonary edema
  ▪ Etiology/pathophysiology
    • Accumulation of fluid in lung tissues and alveoli
Complication of congestive heart failure (CHF)

Clinical manifestations/assessment

- Restlessness
- Agitation
- Disorientation
- Diaphoresis
- Dyspnea and tachypnea

Disorders of the Heart

Pulmonary edema (continued)

Clinical manifestations/assessment (continued)

- Tachycardia
- Pallor or cyanosis
- Cough—large amounts of blood-tinged, frothy sputum
- Wheezing, crackles
- Cold extremities

Disorders of the Heart

Pulmonary edema (continued)

Medical management/nursing interventions

- Pharmacological management
  - Morphine sulfate
  - Nitroglycerin
  - Diuretics
  - Inotropic agents
  - Vasodilators
- High Fowler’s or orthopneic position
- Oxygen

Disorders of the Heart
- Valvular heart disease
  - Etiology/pathophysiology
    - Heart valves are compromised and do not open and close properly
      - Stenosis
      - Insufficiency
    - Causes may be:
      - Congenital
      - Rheumatic fever

- Disorders of the Heart

- Valvular heart disease (continued)
  - Clinical manifestations/assessment
    - Fatigue
    - Angina
    - Oliguria
    - Pale, cool skin
    - Weight gain
    - Restlessness
    - Abnormal breath sounds
    - Edema

- Disorders of the Heart

- Valvular heart disease (continued)
  - Medical management/nursing interventions
    - Pharmacological management
      - Diuretics
      - Digoxin
      - Antidysrhythmics
    - Restrict activities
    - Sodium-restricted diet
    - Surgery
- Open mitral commissurotomy
- Valve replacement

- Disorders of the Heart

- Rheumatic heart disease
  - Etiology/pathophysiology
    - Rheumatic fever
      - Inflammatory disease that is a delayed childhood reaction to inadequately treated childhood upper respiratory tract infection of beta-hemolytic streptococci
      - Causes scar tissue in the heart

- Disorders of the Heart

- Rheumatic heart disease (continued)
  - Clinical manifestations/assessment
    - Elevated temperature
    - Elevated heart rate
    - Epistaxis
    - Anemia
    - Joint pain and stiffness
    - Nodules on the joints
    - Specific to valve affected
    - Heart murmur

- Disorders of the Heart

- Rheumatic heart disease (continued)
  - Medical management/nursing interventions
    - Pharmacological management
      - NSAIDs
    - Prevention
      - Treat infections rapidly and completely
    - Bed rest
• Application of heat
• Dietary recommendations
  ▪ Well-balanced diet
  ▪ Supplement with vitamins B and C
• Encourage fluids
• Commissurotomy or valve replacement

• Disorders of the Heart

• Pericarditis
  ▪ Etiology/pathophysiology
    • Inflammation of the membranous sac surrounding the heart
    • May be acute or chronic
    • Bacterial, viral, or fungal
    • Noninfectious conditions
      ▪ Azotemia, MI, neoplasms, scleroderma, trauma, systemic lupus erythematosus (SLE), radiation, drugs

• Disorders of the Heart

• Pericarditis (continued)
  ▪ Clinical manifestations/assessment
    • Debilitating pain
    • Dyspnea
    • Fever
    • Chills
    • Diaphoresis
    • Leukocytosis
    • Pericardial friction rub
    • Pericardial effusion

• Disorders of the Heart
• Pericarditis (continued)
  ■ Medical management/nursing interventions
    • Pharmacological management
      ■ Analgesics
      ■ Salicylates
      ■ Antibiotics
      ■ Anti-inflammatory agents
      ■ Corticosteroids
    • Oxygen
    • IV fluids
    • Surgery: pericardial window, pericardial tap

• Disorders of the Heart

• Endocarditis
  ■ Etiology/pathophysiology
    • Infection or inflammation of the inner membranous lining of the heart
  ■ Clinical manifestations/assessment
    • Influenza-like symptoms
    • Petechiae on the conjunctiva, mouth, and legs
    • Anemia
    • Splinter hemorrhages under nails
    • Weight loss
    • Heart murmur

• Disorders of the Heart

• Endocarditis (continued)
  ■ Medical management/nursing interventions
    • Bed rest
    • Antibiotics
      ■ IV for 1 to 2 months
    • Prophylactic antibiotics for "high-risk" patients
• Surgical repair of diseased valves or valve replacement

• Disorders of the Heart

• Myocarditis
  ▪ Etiology/pathophysiology
    • Inflammation of the myocardium
    • Rheumatic heart disease
    • Viral, bacterial, or fungal infection
    • Endocarditis
    • Pericarditis

• Disorders of the Heart

• Myocarditis (continued)
  ▪ Medical management/nursing interventions
    • Bed rest
    • Oxygen
    • Antibiotics; anti-inflammatory agents
    • Assessment and correction of dysrhythmias
  ▪ Clinical manifestations/assessment
    • Vary according to site of infection
    • Cardiac enlargement
    • Murmur; gallop; tachycardia

• Disorders of the Heart

• Cardiomyopathy
  ▪ Etiology/pathophysiology
    • A group of heart muscle diseases that primarily affects the structural or functional ability of the myocardium
    • Not associated with CAD, hypertension, vascular disease, or pulmonary disease
• Primary—unknown cause
• Secondary—infective, metabolic, nutritional, alcohol, peripartum, drugs, radiation, SLE, rheumatoid arthritis

Disorders of the Heart

Cardiomyopathy (continued)
  ▪ Clinical manifestations/assessment
    • Angina
    • Syncope
    • Fatigue
    • Dyspnea on exertion
    • Severe exercise intolerance
    • Signs and symptoms of left- and right-sided CHF

Disorders of the Heart

Cardiomyopathy (continued)
  ▪ Medical management/nursing interventions
    • Pharmacological management
      ▪ Diuretics
      ▪ ACE inhibitors
      ▪ Beta-adrenergic blocking agents
    • Treat underlying cause
    • Internal defibrillator
    • Cardiac transplant

Disorders of the Peripheral Vascular System

Arterial assessment
  ▪ PATCHES
    • P = Pulses
    • A = Appearance
• **T** = Temperature
• **C** = Capillary refill
• **H** = Hardness
• **E** = Edema
• **S** = Sensation

**Venous assessment**
- First symptom is usually edema
- Dark pigmentation
- Dryness and scaling
- Ulcerations
- Pain, aching, and cramping
  - Usually relieved by rest or elevation

**Diagnostic tests**
- Noninvasive procedures
  - Treadmill test
  - Plethysmography
  - Digital subtraction angiography (DSA)
  - Doppler ultrasound
- Invasive procedures
  - Phlebography or venography
  - $^{125}\text{I}$-fibrinogen uptake test
  - Angiography

**Arteriosclerosis**
- Thickening, loss of elasticity, and calcification of arterial walls, resulting in decreased blood supply

**Atherosclerosis**
- Narrowing of the artery due to yellowish plaques of cholesterol, lipids, and cellular debris in the inner layers of the walls of large- and medium-sized arteries
- A type of arteriosclerosis
Hypertension

- Etiology/pathophysiology
  - A sustained elevated systolic blood pressure greater than 140 mm Hg and/or a sustained elevated diastolic blood pressure greater than 90 mm Hg.
  - Vasoconstriction (increases blood pressure)
  - Essential (primary) hypertension
    - 90% to 95% of all diagnosed cases
  - Secondary hypertension
    - Attributed to an identifiable medical diagnosis

Hypertension (continued)

- Clinical manifestations/assessment
  - Headache; blurred vision
  - Epistaxis
  - Angina

- Medical management/nursing interventions
  - Pharmacological management
    - Antihypertensive medications; diuretics
  - Dietary recommendations
    - Weight control, reduction of saturated fats, and low sodium
  - No smoking

Arteriosclerosis obliterans

- Etiology/pathophysiology
  - Narrowing or occlusion of the blood vessel with plaque formation—little or no blood flow to the affected extremity

- Clinical manifestations/assessment
  - Pain—intermittent claudication
  - Pulselessness
  - Pallor
  - Paresthesia
  - Paralysis
Arteriosclerosis obliterans (*continued*)
- Medical management/nursing interventions
  - Anticoagulants
  - Fibrinolytics
  - Surgery
    - Embolectomy
    - Endarterectomy
    - Arterial bypass
    - Percutaneous transluminal angioplasty
    - Amputation

Arterial embolism
- Etiology/pathophysiology
  - Blood clots in the arterial bloodstream
  - May originate in the heart
  - Foreign substances
- Clinical manifestations/assessment
  - Pain
  - Absent distal pulses
  - Pale, cool, and numb extremity
  - Necrosis

Arterial embolism (*continued*)
- Medical management/nursing interventions
  - Pharmacological management
    - Anticoagulants
    - Fibrinolytics
  - Endarterectomy
  - Embolectomy

Arterial aneurysm
- Etiology/pathophysiology
• Enlarged, dilated portion of an artery
• Causes: arteriosclerosis; trauma; congenital

Clinical manifestations/assessment
• Asymptomatic
• Large pulsating mass
• Pain, if large enough to press on other structures

Figure 48-20

Arterial aneurysm (continued)

Medical management/nursing interventions
• Assess for signs and symptoms of rupture, thrombi, ischemia
• Control hypertension
• Surgery
  ▪ Ligation
  ▪ Grafts

Thromboangitis obliterans (Buerger’s disease)

Etiology/pathophysiology
• Occlusive vascular condition in which the small and medium-sized arteries become inflamed and thrombotic

Clinical manifestations/assessment
• Pain; sensitivity to cold
• Skin cold and pale
• Ulcerations on feet or hands; gangrene
• Superficial thrombophlebitis

Thromboangitis obliterans (Buerger’s disease) (continued)

Medical management/nursing interventions
• No smoking
• Exercise to develop collateral circulation
• Surgery
  ▪ Amputation of gangrenous fingers and toes
- Sympathectomy

• Raynaud's disease
  ▪ Etiology/pathophysiology
    • Intermittent arterial spasms
    • Primarily affects fingers, toes, ears, and nose
    • Exposure to cold or emotional stress
  ▪ Clinical manifestations/assessment
    • Chronically cold hands and feet
    • Pallor, coldness, numbness, cyanosis, and pain during spasms; erythema following a spasm
    • Ulcerations on the fingers and toes

• Raynaud's disease (continued)
  ▪ Medical management/nursing interventions
    • Pharmacological management
      ▪ Vasodilators
      ▪ Calcium antagonists
      ▪ Muscle relaxants
    • Surgery: sympathectomy
    • No smoking
    • Avoid exposure to cold
    • Amputation for gangrene

• Thrombophlebitis
  ▪ Etiology/pathophysiology
    • Inflammation of a vein in conjunction with the formation of a thrombus
    • Risk factors: venous stasis, hypercoagulability, trauma of a blood vessel, immobilization after surgery
  ▪ Clinical manifestations/assessment
    • Pain
    • Edema
    • Positive Homans' sign
• Erythema, warmth, and tenderness along the vein

Figure 48-23

Thrombophlebitis (continued)

- Medical management/nursing interventions
  - Superficial
    - Pharmacological management
      - NSAIDs
    - Bed rest
    - Moist heat
    - Elevate extremity

Thrombophlebitis (continued)

- Medical management/nursing interventions
  - Deep
    - Pharmacological management
      - Anticoagulants
      - Fibrinolytics
    - Bed rest
    - Elevate extremity
    - Antiembolism stockings
    - Surgery: thrombectomy; vena cava umbrella (Greenfield filter)

Varicose veins

- Etiology/pathophysiology
  - Tortuous, dilated vein with incompetent valves
- Clinical manifestations/assessment
  - Dark, raised, tortuous veins
  - Fatigue; dull aches
  - Cramping of the muscles
  - Heaviness or pressure of extremity
  - Edema, pain, changes in skin color, and ulcerations with venous stasis

Varicose veins (continued)

- Medical management/nursing interventions
• Elastic stockings
• Rest
• Elevate legs
• Sclerotherapy
• Surgery
  - Vein ligation and stripping

Venous stasis ulcers
  - Etiology/pathophysiology
    • Ulcerations of the legs from chronic deep vein insufficiency and stasis of blood in the venous system of the legs
    • Open necrotic lesion due to an inadequate supply of oxygen-rich blood to the tissue
    • Causes
      - Varicose veins, burns, trauma, sickle cell anemia, diabetes mellitus, neurogenic disorders, and hereditary factors

Venous stasis ulcers (continued)
  - Clinical manifestations/assessment
    • Pain
    • Ulceration with dark pigmentation
    • Edema
  - Medical management/nursing interventions
    • Diet: increased protein; vitamins A and C and zinc
    • Debridement of necrotic tissue
    • Antibiotics
    • Unna boot

Figure 48-17

Nursing Process

Nursing diagnoses
  - Activity intolerance
- Anxiety
- Decreased cardiac output
- Ineffective coronary tissue perfusion
- Fluid volume excess
- Impaired gas exchange
- Knowledge, deficient
- Pain