Diseases of the Circulatory System

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Class 8: Cardiac Objectives

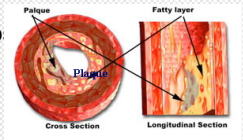
- Upon completion of this lesson, the student will be able to
- Distinguish between arteriosclerosis and atherosclerosis; describe the formation and consequences of atheromatous plaque.
- Determine the etiology and treatment of hypertension.
- Distinguish between primary and secondary hypertension and identify classifications of hypertension for adults
- Determine risk factors and signs/symptoms associated with CAD, PVD and DVTs. Formulate nursing interventions for CAD.
- Compare and contrast the etiology and manifestations of myocarditis and pericarditis with a classmate.
- Identify the types of angina and arrhythmias associated with myocardial ischemia and infarction.
- Compare and contrast the etiology of right & left sided heart failure and explain to a classmate the different signs and symptoms.

Arteriosclerosis

- Chronic disease of the arterial system
  - Characterized by an abnormal thickening and hardening of the vessel walls.
    - Smooth **muscle cells** and **collagen fibers** move into the ***tunica intima*** causing stiffening
    - Inhibits the artery's ability to change lumen size
  - Structural changes may be due to the normal aging process
    - Changes in lipid, cholesterol, and phospholipids are contributing factors

Atherosclerosis Plaque Formation

- *A form of arteriosclerosis in which the hardening of the vessel walls are caused by soft deposits of **intrarterial fat** and **fibrin** that harden over time*
- Damaged endothelium
- Fatty streak formation
- Fibrous plaque develop
- Complicated lesion



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Atherosclerosis

("fat scar" or "atheromas")

- Plaque can ulcerate or rupture before occluding the vessel
- Thrombosis forms and complete vessel occlusion occurs
  - *Causing tissue ischemia and infarction*
- Prevention can include antiplatelet meds

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Atherosclerosis

- ***Clinical symptoms***
  - *Due to inadequate perfusion of tissues*
    - *Transient ischemic attacks (TIA) associated with stress or exercise*
    - *CAD caused by atherosclerosis is cause for myocardial ischemia*
    - *Obstruction of vessels leading to the brain cause CVA*
    - *May elevate the total systemic vascular resistance and cause high blood pressure (hypertension)*

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Hypertension
"a cause of pump failure"

- ***Consistent elevation of systemic arterial blood pressure***
  - *Average of two or more diastolic pressures made on two or more consecutive clinical visits is 90 mm Hg*
  - *Or, the average of systolic pressures made on 3 visits is greater than 140 mm Hg*
- Stage 1 (mild) (S) 140-159 over (D) 90-99
- Stage 2 (moderate) (S) 160-179 over (D) 100-109
- Stage 3 (severe)(S) > or equal to 180; (D) over > or equal to 110

Hypertension

- ***Etiology: caused by increases in cardiac output, total peripheral resistance, or both***
  - ***Cardiac output is increased d/t any condition that increases heart rate***
  - ***Total peripheral resistance is increased by any factor that increases the blood viscosity or reduces vessel diameter***
- ***Signs & Symptoms:***
  - ***"Silent killer" : no signs and symptoms***
  - ***Some: headache, epistaxis, or orthostatic hypotension***
  - *Target organs will begin to deteriorate*
    - *cardiac failure, left ventricular hypertrophy, CVA, PVD, renal failure, retinopathy*

Hypertension

- ***Primary: "essential"*** *= unknown cause = 90-95% of cases*
  - *At risk:*
    - *ASHD, > age, obesity, > lipids,> glucose levels, ETOH abuse*
  - *hypertension accelerates atherosclerosis & vice versa*
  - *50 million Americans (6 and older) have hypertension*
  - *1 in 4 Americans have hypertension*
  - *Mortality: (males: 40% & females: 60%)*
  - *Cigarette smoking increases risk of atherosclerosis*
  - *Genetic and environmental factors*

Hypertension

- ***Secondary:*** *Caused by altered hemodynamics associated with primary disease processes*
  - *Renal failure or renin producing tumors*
  - *Neoplasia: Wilm's Tumor*
  - *Phenochromacytoma: adrenal medulla tumor*
  - *Pregnancy-induced hypertension*
  - *Hyperthyroidism*
  - *Primary aldosteronism*

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Coronary Artery Disease

- The single leading cause of death of American males and females
- Persistent ischemia or a complete occlusion of a coronary artery causes infarction, or death, of the deprived myocardial tissue

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Coronary Artery Disease

- Risk factors
  - Total serum cholesterol > 240 mg/dL
    - LDL cholesterol > 160 mg/dL
  - Obesity &Smoking
  - Diabetes Mellitus
  - Decreased High Density Lipids
  - Decreased estrogen levels
  - Dyslipidemia & Hyperhomocysteine
  - Sedentary life style

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Coronary Artery Disease

- Dyslipidemia
  - Disorders of lipoprotein metabolism, may be manifested by
    - > total serum cholesterol
    - > LDL and triglycerides
    - < HDL cholesterol concentration
  - Causal relationship between > cholesterol levels and CHD.
    - Cholesterol lowering Rx reduces lipid content of atherosclerotic plaque (e.g. Simvastatin)

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Coronary Artery Disease

- Hyperhomocysteine
  - Due to a genetic lack of the enzyme that breaks down homocysteine
  - And/or a nutritional lack of folate, cobalamin, or pyridoxine
    - < levels of folic acid, B_{12}, B_6 hampers the natural breakdown of homocysteines
  - Causes the arteries to narrow and harden
  - Check serum levels
  - Encourage a diet rich in folate and B vitamins

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Peripheral Artery Disease

- *Buerger's disease, also known as "thromboangiitis obliterans"*
  - Inflammatory disease of peripheral arteries
  - Affects the small and medium arteries and veins of upper and lower extremities
  - High association with tobacco use and males
- Pain and tenderness; shiny skin; gangrene?
  - http://www.nytimes.com/2003/06/10/health/10BROD.html

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Peripheral Artery Disease

- Raynaud Phenomenon
  - *Local vasospasm of the small arteries*
    - *secondary to systemic diseases*
      - *Scleroderma, pulmonary hypertension, malignancy*
- Raynaud Disease
  - *Primary vasospastic disorder*
  - *the digit turns white, blue, red*
    - *pain, numbness & cold sensation may be present*

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DVT

- Deep Vein Thrombosis
  - Asymptomatic, however associated with risk factors
    - Venous stasis: immobility, age, left heart failure
    - Vessel damage: trauma, IV medications
    - > Coagulation: pregnancy, oral contraception, some cancers, coagulation disorders
  - Prevention: ambulation following surgery!

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Cardiac Inflammation

- Myocarditis: forms scar tissue
  - inflammation & injury of myocardium without ischemia
  - caused by an infection with virus or bacterial protein that triggers an autoimmune attack on myocardial cells
  - CMV, HIV, Hep B, coxsackievirus
  - TB, B-hemolytic strep, slamonella, lyme disease
  - fungi: candidiasis, histoplasmosis, chalmydia
- S&S:
  - flu like symptoms; fatigue; dyspnea; chest pain, IDC (idiopathic dilated cardiomyopathy), cardiac death
  - decreases ejection fraction (15%)

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Cardiac Inflammation

- Pericarditis
  - Inflammation of pericardial sac layers
  - Trauma, viral, neoplasms,MI, flu, iatrogenic
  - At risk: renal failure, radiation therapy, drugs or post-surgical open heart
  - Pre-load is compromised d/t inflammation
- S&S:
  - fever, severe chest pain upon deep inspiration, pericardial effusion, pericardial friction rubs;
  - cardiac tamponade with pulsus paradoxus : < systolic BP during inspiration

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Myocardial Ischemia

- Stable angina: chest pain d/t myocardial ischemia
  - Transient and generally lasts 3 to 5 minutes
- Angina Pectoris
  - Generally substernal and confused with indigestion, pain in jaw, neck, and/or shoulder; Emotional stress or physical exertion
  - Pain is relieved with rest/nitroglycerin
  - Lack of relief? Myocardial Infarction?
- Prinzmetal angina: transient ischemia of myocardium at unpredictable moments and almost always at rest
  - Occurs at night during rapid eye movement sleep

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Myocardial Ischemia

- Leads to dysrhythmias, heart failure, sudden death
- ECG changes: ST depression, T wave inversion , and ST segment elevation
- Infarction leads to cell death & irreversible damage
- Clinical presentation: angina, vasovagal reflexes, cool, pale, diaphoretic
- ECG changes: p.1015
  - Ischemia (ST depression)
  - Zone of injury (ST elevation)
  - Zone of infarction/necrosis (abnormal Q wave)

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Myocardial Infarction
A Complication of CHD

- "Ischemia with death to myocardium d/t lack of blood supply from the occlusion of coronary artery and its branches" (Hartshorn, 1997)
  - imbalance between myocardial oxygen supply and demand
  - imbalance is result of atherosclerosis, coronary artery vasospasm, thrombus, or dysrhythmias
  - prolonged ischemia is called an "infarction"
    - evolves over 3 hours & causes irreversible cellular damage and muscle death (necrosis)

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Myocardial Infarction
Clinical Symptoms

- > Cardiac Enzymes d/t myocardial ischemia
  - CK: "creatine kinase" onset = 2-6 hrs after MI
  - LDH: "lactate dehydrogenase" = 12 hrs after MI
  - AST: "asparate transaminase" + 6-8 hrs after MI
  - Troponin: protein marker for early detection of MI
- MI: 20 - 60% are "silent" (signs and symptoms)
  - skin is cool, clammy, pale, & diaphoretic
  - Color of skin is dusky, ashen, hyperthermic
  - SOB, dyspnea, tachypnea, hypotension,
  - anxious, denial, depression, "impending doom or death", nausea, vomiting

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Congestive Heart Failure

- The heart is unable to sufficiently pump blood in order to meet the metabolic needs of the body.
- This inability to pump causes decreased perfusion & decreased cardiac output
- Acute: Pulmonary edema
- Chronic: Heart failure
  - Left-sided; Right-sided; Both

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CHF

- Etiology
  - Myocardial Infarction
  - Hypertension
  - Coronary Artery Disease
  - Kidney failure
  - Cardiomyopathies
  - Side effects of medications
    - e.g. Corticoidsteroids
  - Valve disease

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CHF

- Left-sided
  - Failure of the left ventricle to pump blood received from the R side of the heart
  - Pulmonary circuit becomes congested with blood
  - Remember: “L”eft and “L”ung
  - Etiology-
    - A common cause is MI
    - Systemic Hypertension
    - Cardiomyopathy

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CHF

- Left-sided Signs & Symptoms
  - Activity intolerance
  - Fatigue
  - Dyspnea & Cough
  - Pulmonary crackles
  - S3 heart sound
  - Tachycardia
  - Syncope

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CHF

- Right-Sided
  - Caused by pulmonary hypertension and left heart failure
  - Right ventricular infarction can cause right-sided CHF
  - Right ventricular distention leads to blood accumulation in the systemic venous system
    - Remember: “R”ight and “R”est of the body

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CHF

- Right-sided Signs & Symptoms
  - Abdominal organ congestion
    - Anorexia & Nausea with GI venous congestion
  - Peripheral edema
    - Lower-extremity edema in ambulatory patient
    - Sacral edema in bedridden patient
  - Liver engorgement
    - Right upper quadrant (RUQ) pain
  - Jugular vein distention

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