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 development
- Complicated lesion

**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

**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)
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

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

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

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

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
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)

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, B₁₂, B₆ 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

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?
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

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!

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, stamonelia, 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%)
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

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

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)
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)

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: “aspartate 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

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
**CHF**

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

**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

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

- Right-sided Signs & Symptoms
  - Abdominal organ congestion
    - Anorexia & Nausea with Gl 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

References

- http://www.heartsite.com
- Illustrations in this presentation used are from HeartSite.com