Cardiovascular and Circulatory Study Chart – Chapter 7

Referenced from ANPH 202 course textbooks:
Eisenberg, R. L. and Johnson, N. L. Comprehensive Radiographic Pathology. St. Louis, MO: Elsevier

Patton, K. T. and Thibodeau, G.A. The Human Body in Health and Disease. St. Louis, Missouri: Elsevier

Patent Ductus Arteriosis	**What is it?** The ductus arteriosus is a vessel that runs from the bifurcation of a fetus's pulmonary artery to the aorta, just distal to the left sublclavian artery. It prevents blood from circulating to the fetus's undeveloped lungs. It should close at, or shortly after birth. If it remains "patent" (open) after birth, the neonate is said to have a "patent ductus arteriosis" This condition is more likely to occur in premature infants.	**Complications:** After birth, blood pressure is greater on the systemic side of the heart than on the pulmonary side, so some of the blood in the aorta, gets shunted back to the pulmonary trunk through the patent ductus arteriosis. The increased blood flow in the pulmonary arteries, lungs, left atrium and ventricle, and proximal aorta causes enlargement of these affected anatomical parts. Pulmonary hypertension can ultimately balance or reverse the left-to-right shunt.	**Radiographic Appearance:** Best diagnosed with ultrasound, MRI, and angiographic procedures, but chest x-rays will provide an initial assessment of the size, shape, and position of the heart and pulmonary vasculature. Small defects may resolve on their own, but medication or surgery may be required.	**Eisenberg fig. 7-6 and 7-7** Eisenmenger's syndrome refers to the chronic pulmonary hypertension associated with this condition
Atrial Septal defect	**What is it?** The foramen ovale normally closes off during the first year of life, but in this condition it fails to do so.	**Complications:** Blood from the higher pressure left atrium is shunted to the lower pressure right atrium after birth, which in turn increases the workload of the right ventricle and leads to increased blood flow to the lungs.	**Radiographic Appearance:** chest x-ray will show enlargement of the pulmonary "outflow tract" (leading to the pulmonary valve, right atrium, and ventricle, with increased lung markings due to increase blood flow in the lungs.	**Eisenberg fig. 7-4**

Ventricular Septal defect	What is it? An abnormal opening between the right and left ventricles that causes a left to right shunting of blood.	Complications: Increased blood flow to and from the lungs. Increased workload for the left atrium and ventricle leading to enlargement of these chambers. Note: The right ventricle does not enlarge as shunting occurs during systole only, so blood shunted to the right ventricle is immediately pushed into the pulmonary artery.	Radiographic Appearance: chest x- ray will show enlargement of the pulmonary trunk, left atrium and ventricle, as well as increased pulmonary vascular volume (markings).	Eisenberg fig. 7-5
Tetrology of Fallot	What is it? A combination of four defects: 1) pulmonary valve stenosis 2) high (superior) ventricular septal defect 3) overriding aorta (the opening of the aorta arches over the ventricular septal defect so that it ends up opening into both the right and left ventricles 4) hypertrophy of the right ventricle.	Complications: The pulmonary valve stenosis causes increased pressure in the right atrium leading to hypertrophy. It also prevents the normal amount of blood from reaching the lungs for oxygenation. Deoxygenated blood is pumped out to the body because of the overriding aorta and ventricular septal defect.	Radiographic Appearance: Chest x-ray will show enlarged right ventricle causing upward lateral displacement of the apex of the heart. Heart shadow will have the classic "coeur en sabot" or "wooden shoe" appearance. ¼ of patients have the aorta on the right side. Best demonstrated with ultrasound. Without surgery most patients will die before puberty, and in some cases surgery is palliative only.	Eisenberg Fig. 7-9
Coarctation of the aorta	What is it? A stenosis of the descending aorta, just distal to the arteries that branch off to supply blood to the head, neck, and upper extremities.	Complications: Because of the location of the stenosis, circulation to the upper extremities and head is normal, but there is decreased blood flow to the lower limbs and abdomen. This is the most common cause of hypertension in children. Can be treated with aortic resection.	Radiographic Appearance: The descending aorta has bulges on either side of the narrowing, which causes the "figure "3 sign to be visualized on a chest radiograph, and a "figure E" to be visualized on an esophagram. Bony erosions occur in the ribs due to enlargement of collateral vessels.	Eisenberg 7-10 and 7-11

Arteriosclerosis and atherosclerosis	**What is it?** "hardening of the arteries". Arteriosclerosis is a general term that describes a thickening and loss of elasticity in the walls of arteries. Atherosclerosis is a more specific term that refers to the build-up of fibro-fatty deposits (plaques). The abdominal aorta, common iliacs, femoral, cerebral, and coronary arteries are most often affected. Most prevalent disease in humans! Risk factors include high-cholesterol diet, smoking, obesity, lack of exercise, diabetes, hypertension and genetics.	**Complications:** Stenosis or occlusion of affected arteries can cause pathologies related to ischemia or necrosis of body tissues. For example, CAD, cerebrovascular accidents, and myocardial infarction. Increases the risk for aneurysm.	**Radiographic Appearance:** Conventional x-rays will show calcifications on vessel walls in advanced stages. Angiography is modality of choice for diagnosis and treatment.	Eisenberg 7-42 and 7-43
CAD Coronary artery disease	**What is it?** Atherosclerosis in the coronary arteries which supply blood to the heart. Prevents coronary vessels from expanding properly during systole.	**Complications:** decreased blood supply to the heart muscle leading to ischemia, or necrosis (infarct). Symptoms range from angina pectoris (see below) to myocardial infarction (heart attack) May be treated with Medications or surgical interventions such as angioplasty, or bypass surgery.	**Radiographic appearance:** Can be diagnosed with angiography, nuclear medicine perfusion scans, echocardiography, CT and MRI.	Eisenberg 7-13, 7-15,7-16
Aneurysm	**What is it?** A weakness in the wall of an artery that causes a localized bulging. Saccular involves one side of artery; fusiform involves entire circumference; dissecting involves separation of the tunica intima from the tunica media. Causes include arteriosclerosis, trauma, genetics, or infection. abdominal aorta aneurysms (AAA) usually occur inferior to the renal arteries.	**Complications:** Hemorrhage may lead to death.	**Radiographic appearance:** Ultrasound, CT and MRI are modalities of choice. Aortography (done in angio) is invasive, but effective.	Eisenberg 7-32, 7-33, 7-34, 7-37, 7-39, 7-41

Myocardial Infarction	**What is it?** Death of some portion of the heart muscle (heart attack) most commonly caused by an acute thrombus in the coronary arteries. In men symptoms include severe pain, SOB, profuse diaphoresis, nausea and vomiting. In women symptoms are less severe.	**Complications:** **Angina pectoris** is severe chest tightness, and pain that radiates to the jaw, neck, and left arm, because of a temporarily insufficient supply of oxygen to the heart. It can occur when increased oxygen demands are placed on the heart during exercise, a heavy meal, emotional stress or severe cold. **Myocardial infarction**: Heart attack: is death of some portion of the heart muscle due to lack of oxygen. The degree of heart muscle involvement will determine the patient's prognosis.	**Radiographic appearance**: CAD is diagnosed with angiography, and thrombolytic therapy is treatment of choice especially if administered within hours of initial attack.	No image.
Heart failure	What is it? Left-sided heart failure (aka. congestive heart failure) occurs when the LV cannot pump blood effectively. It is usually caused by a CAD, valve disease, or hypertension. Right-sided heart failure most often occurs secondary to severe left-sided heart failure because back-up of blood on the in lungs is too much for the right-ventricle to overcome. Can also be caused by pulmonary valve stenosis, emphysema, and pulmonary emboli.	**Complications:** Left sided heart failure: decreased systemic pumping pressure causes widespread fluid retention in body tissues, cardiomegaly, and back-up of blood in the pulmonary circulation. Right-sided heart failure: dilation of the RA, RV, and SVC and edema in the lower extremities. Liver congestion may elevate the right hemi-diaphragm.	**Radiographic Appearance:** Cardiomegaly, increased lung density due to pulmonary edema, pleural effusion, elevated right hemi-diaphragm.	Eisenberg 7-19 and 7-20

Arrhythmias	What is it? Any condition where the heart cannot beat in a normal rhythm: Bradycardia – slow heart rhythm Tachycardia – rapid heart rhythm Sinus dysrhythmia – a heart rate that increases with inspiration and decreases with expiration Premature contractions (extrasystoles) – heart contractions that occur before the expected time. May be caused by lack of sleep, anxiety, cold medication, too much caffeine or nicotine Fibrillation – individual cardiac muscle fibre contractions are out of sync with one another.	Complications: Ventricular fibrillation is immediately life-threatening but can sometimes be treated with electrical shock using an automatic external defibrillator (AED) Atrial fibrillation can be treated through atrial ablation which is surgical process that involves intentional localized destruction of some heart muscle.	Radiographic Appearance: An artificial pacemaker or ICD (implantable cardioverter-defibrillator) can be implanted in patients that are prone to cardiac fibrillation or other dysrhythmias. These devices can be visualized on chest x-rays, and any patient who has recently had a new implant.	Eisenberg fig. 3-8, and 3-9
Valvular Disease	What is it? 1) a heart valve is stenotic or, 2) a heart valve is insufficient and cannot close properly, so that blood is able to leak backwards through the valve (regurgitation) Either condition will cause a characteristic sound of abnormal blood flow known as a "heart murmur". Most commonly occurs in the mitral valve or aortic valves secondary to rheumatic fever.	Complications: Mitral valve stenosis slows blood flow between the left atrium and the left ventricle which in turn leads to hypertrophy of the left atrium and the right side of the heart (think of volume delays in the right side of the heart because blood returning from the lungs can't flow into the already "full" left atrium. The enlarged LA can displace surrounding structures such as the esophagus, or the mainstem bronchus. A stenotic aortic valve increases the workflow of the LV.	Radiographic Appearance: Best diagnosed with ultrasound, but artificial valves will be seen on chest x-rays.	Eisenberg 7-48,7-50, 7-52

Pulmonary edema	What is it? Build-up of fluid in the interstitial spaces of the lung parenchyma, due to increased pulmonary venous pressure. Most commonly caused by left-sided heart failure, but may also originate from valve disease, left-atrial tumor, or lymphatic blockage.	Complications: compromised lung function, sometimes described as "drowning from the inside out" Treatment includes avoiding physical stress, decreasing salt intake, wearing compressive stockings, and medications to reduce fluid retention.	Radiographic Appearance: Loss of clearly defined lung markings. Severe cases that involve the aveolar sacs will cause the "bat's wing or butterfly sign" demonstrated in fig. 7-22. Right-sided pleural effusion is also common.	Eisenberg 7-21, 7-22, 7-23
DVT- Deep Vein Thrombosis	What is it? DVT is a blood clot formed in a lower extremity vein. May be caused by trauma, bacterial infection, prolonged bed rest, and oral contraceptives. Emboli can also be composed of fat, air, cancer cells, or pyogenic bacteria.	Complications: most important complication is pulmonary embolism, but anytime an embolus occludes an artery, affected tissues will become necrosed. Figure	Radiographic appearance: Ultrasound is modality of choice, but venography may be used to confirm diagnosis. May be placed on anticoagulants or receive thrombolytic therapy.	No pertinent image
Pulmonary Emboli	What is it? An acute pathology that occurs when a piece of thrombus that has broken loose, enters the blood stream and becomes lodged in a pulmonary artery thereby obstructing blood flow to the lungs. Most often (95% of the time) originates from a DVT.	Complications: may lead to ARDS – acute respiratory distress syndrome, heart failure, or cardiogenic shock, depending on extent of obstruction, and patient history. Risk increases with bed rest and inactivity. Anticoagulants are administered to dissolve or prevent the development of DVT.	Radiographic appearance: Pulmonary angiograms and nuclear VQ scans can be used but CT is fastest and least expensive. Thrombolytic therapy, anticoagulants, and IVC filters placed under fluoro are treatments of choice. Extreme cases may require surgery.	No image

Varicose veins	**What is it?** Veins that are permanently dilated and tortuous, because of blood that has pooled in them. Most often found in the superficial veins of the lower extremities. Causes include: congenital weakness of valves or venous walls, deep vein thrombophlebitis, hemostasis caused by pregnancy or occupations that require a lot of standing.	**Complications:** The dilation of the venous lumen gives rise to leaky "incompetent" valves. The compromised venous flow can lead to superficial ulcers. Compression stockings, leg elevation, and exercise that promotes muscular contraction of leg muscles will help to minimize pooling. Surgical removal (stripping) or tying off (ligation) of veins is a last resort.	**Radiographic appearance:** Usually diagnosed clinically by noticing multiple purple-bluish superficial nodules. Venography can be used to evaluate patency of deep venous system and presence of collateral vessels. The hemostasis can lead to the development of phleboliths which are calcified blood clots in the affected veins.	Eisenberg 7-63 and 7-64 Patton and Thibodeau pg. 408