Chapter 1

Cardio-Pulmonary and Vascular Disease
Angina Pectoris

Pathophysiology

Angina often occurs when the heart muscle needs more oxygen carrying blood than it is getting, such as during times of physical activity or strong emotions. Severely narrowed coronary arteries, due to atherosclerosis or fatty plaque deposits, may only allow enough blood to reach the heart when the demand for oxygen is low. With physical exertion, like walking up a hill or climbing stairs, the heart works harder and needs more oxygen. The narrowed coronary arteries are unable to provide the additional blood flow required. The resulting decreased myocardial oxygen perfusion, known as ischemia, produces the symptoms of angina.

Signs and Symptoms

- Onset of pain occurs when the heart must work harder, usually during physical exertion or stress
- Mid-sternal dull chest pain or pressure that spreads to the arms, back, or neck
- Pain may feel like gas or indigestion
- Pain is relieved by rest, oxygen administration, nitroglycerine tablets or a combination of the three.
Myocardial Infarction (MI)

Pathophysiology

A myocardial infarction (heart attack) occurs when the flow of oxygen-rich blood, through the coronary arteries, suddenly becomes blocked. As the heart muscle is starved of oxygen decreased myocardial oxygen perfusion occurs (ischemia), and if the blood flow isn't restored quickly the section of heart muscle affected begins to die (infarction). Normally a heart attack is preceded by a buildup of fatty plaque in the coronary arteries which reduces blood flow. The occlusion of the coronary artery occurs due to either a rupture of the plaque or a blood clot becoming trapped in the narrow blood vessel.

Signs and Symptoms

- Dull pain, fullness, and/or squeezing sensation in the middle of the chest
- Pain radiation to the jaw, arm or back
- Shortness of breath
- Nausea, vomiting, and/or general epigastric discomfort
- Cool, clammy skin, profuse sweating (diaphoresis)
- Heartburn and/or indigestion
- General malaise (vague feeling of illness)
- Feeling of “impending doom”
Introduction

Congestive heart failure (CHF) is a chronic condition that affects the chambers of the heart. Heart failure means that the heart's pumping power is weaker than normal due to some form of damage to the heart muscle. With heart failure, blood moves through the heart and body at a slower rate, and pressure in the heart increases. As a result, the heart cannot pump enough blood and oxygen to meet the body's needs.

The chambers of the heart may respond to this inability to meet the body’s need’s by stretching to hold more blood, to pump through the body, or by becoming stiff and thickened. Although these changes may help to keep the blood moving, eventually the heart muscle walls will weaken and become unable to pump efficiently.

Common causes of heart failure include coronary artery disease, myocardial infarction (heart attack), high blood pressure, atrial fibrillation, heart valve disease and infection. Depending on which side of the heart is affected, congestive heart failure can manifest as either right sided congestive heart failure, left sided congestive heart failure or both.
Right Sided Congestive Heart Failure (RCHF)

Pathophysiology

Right-sided CHF is when the right ventricle has become damaged and weakened to the point that the heart can’t pump blood efficiently. Blood builds up in the vena cava entering the right side of the heart, which causes fluid retention in the lower extremities, abdomen, and other vital organs.

Signs and Symptoms

- Swelling (edema) of the feet, ankles, legs, abdomen or sacrum
- Urinating more frequently at night
- Pronounced neck veins
- Abnormal heart beat or palpitations
- Rapid weight gain
Left Sided Congestive Heart Failure (LCHF)

Pathophysiology
Left-sided CHF is when the left ventricle has become damaged and weakened to the point that the heart can't pump blood efficiently. Blood backs up in the pulmonary veins entering the left side of the heart, which causes fluid retention in the lungs (pulmonary edema).

Signs and Symptoms
- Difficulty or labored breathing (dyspnea)
  - Difficulty breathing while lying down (orthopnea)
  - Waking from sleep unable to breath (paroxysmal nocturnal dyspnea)
  - Difficulty breathing when exerting yourself (exertional dyspnea)
- Abnormal lung sounds - fluid in the lungs (crackles/rales) usually in both bases when sitting up or standing
- Coughing up pink, frothy sputum
- Abnormal heart beat or palpitations
- Severe fatigue
Pulmonary Embolus (PE)

Pathophysiology

A pulmonary embolus is a blockage of the main artery of the lung, or one of its branches, by a foreign substance (embolism). The most common source of an embolism is a blood clot from the deep veins of the leg or clots produced in the heart due to a cardiac arrhythmia such as atrial fibrillation. Other sources for an embolism can be air from damaged lungs, fat from atherosclerosis or amniotic fluid that enters the blood stream of the mother during child birth.

Signs and Symptoms

- Sudden onset of chest pain, sometimes sharp, that may worsen with deep inhalation or coughing
- Chest pain that gets worse with exertion but won’t go away with rest
- A cough that may produce bloody or blood-streaked sputum
- Difficulty breathing (dyspnea)
- Abnormal oxygen levels by pulse oximetry but with clear lung sounds
- Cool, clammy skin
Non-Cardiac Chest Pain

Pathophysiology

Chest pain not associated with cardiac related problems. Muscle pain and tenderness in the joints are perhaps the most common causes of non-cardiac chest pain. The lining or pleura around the lungs may be associated with pain if it becomes irritated (pleuritic) or inflamed as in pneumonia.

Another source of chest pain is the esophagus, the tube that carries food from the mouth to the stomach. Acid backing up (refluxing) from the stomach into the esophagus causes pain that can mimic a heart disorder, as can spasms of the esophagus.

Signs and Symptoms

- Gradual or sudden onset of pain, usually does not radiate
- Pain that varies with posture or upper body movement
- Sharp, stabbing, burning or “knife like” pain
- Pain that increases on eating, movement, palpation, inspiration or coughing
**Introduction**

Chronic Obstructive Pulmonary Disease (COPD) is not one single disease but an umbrella term used to describe chronic lung diseases that cause limitations in lung airflow. COPD is a combination of a minimum of two different types of respiratory diseases such as asthma, emphysema, or chronic bronchitis.

The most common symptoms of COPD are breathlessness, or a 'need for air', excessive sputum production, and a chronic cough. It is a life threatening lung disease that may progressively lead to death. Common symptoms include chronic productive cough, shortness of breath while doing everyday activities (dyspnea), frequent respiratory infections and fatigue.
Asthma is a chronic condition in which the airways become swollen, narrow and produce excess mucus. This reversible airway obstruction can make breathing difficult. An asthma attack can be triggered by airborne allergens, respiratory infections, physical activity, cold air or air pollutants and irritants.

**Signs and Symptoms**

- Severe shortness of breath (dyspnea)
- chest tightness or pain
- coughing
- wheezing
**Emphysema**

**Pathophysiology**

Emphysema is a long-term, progressive disease of the lungs that can be caused by smoking, inhalation of particulate matter at work (asbestos, coal dust) or chemical inhalation. The primarily cause of the shortness of breath due to over-inflation of the air sacs in the lung (alveoli). In emphysema, the alveoli tissue involved in exchange of gases is impaired or destroyed. When this tissue is damaged the airways collapse (atelectasis) making it difficult for the lungs to release carbon dioxide. The carbon dioxide then becomes trapped in the alveoli interfering with oxygen transfer between the alveoli and the red blood cells.

**Signs and Symptoms**

- Shortness of breath increasing on exertion
- Productive cough
- Wheezing
- Chest tightness or pain
- Continuous abnormal pulse oximetry on room air (below 95%)
**Chronic Bronchitis**

**Pathophysiology**

Chronic bronchitis is a continuous inflammation of the lining of the bronchial tubes. This leads to frequent coughing and difficulty getting air in and out of the lungs. Chronic bronchitis is often characterized by the frequent production of thickened mucus, which can be discolored.

**Signs and Symptoms**

- Cough
- Production of mucus (sputum), which can be clear, white, yellowish-gray or green in color
- Fatigue
- Shortness of breath
- Slight fever and chills
- Chest discomfort
- Abnormal lung sounds - mucous (rhonchi)
Pneumonia

Pathophysiology

Pneumonia is an infection that inflames the air sacs (alveoli) in one or both lungs. The air sacs may fill with fluid or pus (purulent material) interfering with the exchange of oxygen and carbon dioxide during respiration. A variety of organisms, including bacteria, viruses and fungi, can cause pneumonia.

Signs and Symptoms

- Gradual onset of symptoms, sometimes preceded by a upper or lower respiratory tract infection
- Fever, sweating and chills
- Cough, which may produce phlegm (mucous)
- Sharp chest pain which increases on breathing or cough
- Shortness of breath (dyspnea), especially on exertion
- Fatigue
- Nausea, vomiting or diarrhea
- Abnormal lung sounds - fluid in the lung area effected (crackles/rales) and/or mucous (rhonchi)
Deep Vein Thrombosis (DVT)

Pathophysiology

A DVT is the formation of a blood clot (thrombus) within a deep vein, predominantly in the legs. DVT often develops in the calf veins and "grows" in the direction of venous flow, towards the heart. A tendency to form blood clots in the legs can occur when people are immobile, have an increased tendency toward blood clotting, or have injury to veins or their adjacent tissues. A DVT becomes dangerous when a piece of the blood clot breaks off (embolus), travels downstream through the heart into the pulmonary circulation system, and becomes lodged in the lung.

Signs and Symptoms

- Pain in the leg or calf, often it can be of sudden onset
- Swelling of the leg or calf
- Warmth at the site of the DVT
- Tenderness at the site of the DVT
- Redness of the leg
Aortic Aneurysm

Pathophysiology

An aneurysm is an abnormal bulge in the wall of an artery. Normally, the walls of arteries are thick and muscular, allowing them to withstand a large amount of pressure. Occasionally, however, a weak area develops in the wall of an artery. This allows the pressure within the artery to push outwards, creating a bulge or ballooned area called an "aneurysm."

Aortic aneurysms can occur in two main places, either the part of the aorta that passes through the middle to low abdomen or the aorta as it passes through the chest cavity. A thoracic aneurysm is less common than abdominal aneurysms. An aneurysm can be life threatening if the weaken area leaks or ruptures (dissect).

Signs and Symptoms

- Sharp, tearing pain in the chest, abdomen, and/or middle of the back between the shoulder blades during dissection
- Loss of one or both femoral pulses in dissecting abdominal aortic aneurysms (AAA)
- Shortness of breath, hoarseness, cough (due to pressure on the lungs and airways), and difficulty swallowing (pressure on the esophagus) in dissecting thoracic aortic aneurysm (TAA)
- Rupture of an aneurysm can cause loss of consciousness, hypovolemic shock and sudden death