Cardiovascular System and Health

Chapter 15
Cardiovascular Disease

- Leading cause of death in U.S.
- Claims 1 life every 43 seconds
- Often, the first sign is a fatal heart attack
Death Rates

#1 CVD
#2 Cancer
Anatomy of the CV System

- **Heart and Blood Vessels**
  - Heart acts as a pump
    - 5 quarts/min at rest
  - Vessels
    - Arteries ("away")
    - Capillaries
    - Veins ("to the heart")

- **Two circulatory systems**
  - Pulmonary
  - Systemic
Atria – collect blood

Ventricles – pump blood

Right side – collects de-oxygenated blood from the body and pumps it to the lungs

Left side – collects oxygen-rich blood from the lungs and pumps it to the body
Blood Flow thru the CV System

1. Waste-carrying, oxygen-poor blood enters the right atrium from the superior and inferior venae cavae.

2. Blood flows from the right atrium into the right ventricle; from there, it is pumped through the pulmonary arteries into the lungs.

3. In the lungs, blood picks up oxygen and discards carbon dioxide; it then flows through the pulmonary veins into the left atrium.

4. Oxygen-rich blood flows from the left atrium into the left ventricle; from there it is pumped through the aorta into the rest of the body’s blood vessels.
Body...
Vena Cavae...
Right Side...
Pulmonary Arteries...
Lungs...
Pulmonary Veins...
Left Side...
Aorta...
Body...
What Makes the Heart Beat?

- **Sinoatrial Node (SA Node)**
  - The “Pacemaker” of the heart
  - Right Atrium

- **Nerves connecting from the brain to the heart**
  - can regulate heart rate
  - Sympathetic / Parasympathetic pathways of
    Autonomic Nervous System

- **Systole** – contraction of the heart
- **Diastole** – relaxation of the heart
Percentage of Deaths from Cardiovascular Disease (CVD) – Fig. 15-4

- Coronary heart disease: 51%
- Stroke: 17%
- Congestive heart failure: 7%
- High blood pressure: 7%
- Diseases of the arteries: 4%
- Other: 14%
Atherosclerosis

- Fig. 15-5, p. 337
- Narrowing of the arteries, or
- “Thickening” or Hardening of artery walls
  - Begins by early adulthood
  - Accelerated by smoking, inactivity, high blood pressure, high cholesterol, high glucose
Atherosclerosis is a progressive process of Plaque Development

- Injury to inner lining of artery wall
- Lipoproteins (cholesterol carriers) accumulate in the wall, triggering...
- Inflammation (white blood cells)
- WBCs and smooth mm cells release proteins to...
- Form a Plaque (debris that undergoes continual damage, bleeding, calcification)
Process of Atherosclerosis

- Damaged inner lining
- Cholesterol-filled cells
- Plaque and fatty deposits
Plaque Development – Can Cause Blockage of Artery

- Plaque grows bigger and blocks artery
- Plaque can break off and become lodged in a smaller vessel
Major Risk Factors for Heart Disease
aka Coronary Artery Disease (CAD)

RF You CAN Control
- Tobacco Use
- Hypertension
- Unhealthy Blood Cholesterol
- Physical Inactivity
- Obesity, esp Central Abdominal Fat
- Diabetes

RF You CANNOT Control
- Aging (>65 years)
- Being Male
- Family History
- Ethnicity, Low SES
- Postmenopausal
Smoking and CAD

- Leading risk factor for ALL forms of CVD
- Free radicals form, damage inner lining of arteries, speeding up atherosclerosis
- Sticky platelets, blood clots form, trigger spasms that close off arteries
- Nicotine increases HR and BP
- Raises “bad” cholesterol, lowers “good” cholesterol
- Environmental tobacco smoke increases risk
Hypertension

- High blood pressure ($\geq 140 / 90$ mm Hg)
  - Damages inner lining of arteries, speeds atheroscl.
  - Increases workload on heart, causing heart to enlarge, leading to congestive heart failure (CHF)
  - 31% of adult Americans have hypertension
    - Reduced sodium diet, aerobic exercise, lose weight

- “Pre-hypertension” (120 / 80 – 139 / 89)
  - 30% of adults Americans have pre-hypertension
    - Regularly monitor BP
    - Lifestyle changes to prevent and treat obesity

- May have no symptoms (“silent killer”)
Blood Cholesterol

- **Total Cholesterol**
  - Under 200 is desirable
  - 240 or more – high risk

- **High Density Lipoproteins** (HDL) – “Healthy”, good
  - 60 or more is desirable
  - Under 40 – high risk

- **Low Density Lipoproteins** (LDL) – “Lousy”, bad
  - Under 100 is optimal
  - 100-130 is desirable
  - Over 160 – high risk

- **Very Low Density Lipoproteins** (VLDL)
  - Related to triglycerides/fats in blood
1. The liver regulates the body's production of cholesterol, based on the amount of fat and cholesterol that is consumed.

2. Saturated and trans fats in the diet act on the liver to increase the amount of LDL circulating in the blood. Thus saturated and trans fats are more important than dietary cholesterol for raising blood cholesterol to unhealthy levels.

3. The liver packages cholesterol with triglycerides (fat) and sends it into the bloodstream as very low-density lipoproteins (VLDLs).

4. As VLDLs travel through the bloodstream, they are broken down into triglycerides (fat) and cholesterol-rich low-density lipoproteins (LDLs). Triglycerides are used for energy or fat storage.

5. LDLs deliver cholesterol to cells throughout the body. High LDL levels cause an excess of cholesterol to be delivered to cells.

6. Cholesterol not used by the cells spills out and collects on artery walls. The resulting plaque buildup inhibits blood flow and may result in a heart attack.

7. High-density lipoproteins (HDLs) seek out excess cholesterol, reducing the amount available for buildup on artery walls. High HDL levels can help reverse heart disease.

8. HDLs return cholesterol to the liver, where it is converted into bile acids for elimination or recycling.
Other Major Risk Factors...

- Physical Inactivity
- Obesity, Central Abdominal Fat
- Diabetes
Contributing Risk Factors for CAD that you can control

- Excessive alcohol (>3 drinks/day)
- High Triglyceride Levels (>200 mg/dl)
  - Reduce dietary sugars, alcohol, saturated fats
  - Reduce body fat
  - Exercise
- Stress/Lack of social support
Heart Attacks and Other Forms of Heart Disease

- Heart disease is usually a long-developing process
- **Angina** = chest pain, pressure, tightness
- **Heart Attack** = heart muscle cells die, direct result of a blocked coronary artery, resulting in lack of blood supply to the heart
- **Arrhythmia** = disorganized beating of the heart
- **Stroke** = lack of blood supply to the brain, brain cells die
- **Aneurysm** = a bulge in the artery wall
  - May be OK if stable
  - A burst aneurysm results in severe internal bleeding

- **Congenital Heart Disease**
  - **NOT** Coronary Artery Disease
  - Defect present at birth
Coronary Artery Before Angioplasty
Coronary Artery After Angioplasty