Objectives

To review the different forms of heart disease.
- Heart attacks
- Congestive heart failure
- Heart block
- Cor pulmonale
- Pulmonary hypertension
- Cardiac tamponade

To examine factors that influence the heart.
- Medications
- Inotropic agents

To review preload and afterload effects on C.O.

Symptoms of a Heart Attack

Crushing pain in the chest (50%)
Squeezing sensation in the chest.
Nagging discomfort, achy pain under the shoulder blade, along clavicle, in the jaw.
Cold sweat
Shortness of breath at rest.
Nausea
Episodes of dizziness/lightheadedness

Heart Block

Disorder of the heart's electrical system.

1st degree – asymptomatic found on ECG.

2nd degree – arrhythmias, skipped beats. Periodic absence of QRS complex

3rd degree – life threatening requires a pacemaker, can lead to heart failure.

Congestive Heart Failure

Pumping ability of the heart is inadequate to provide normal circulation to meet the body’s needs.
Right heart failure → systemic edema
Left heart failure → pulmonary edema i.e. fluid in lungs

Heart/Lung Associations

Cor pulmonale – right side of heart fails
- Acute – pulmonary embolism
- Chronic – due to lung disorders e.g. emphysema

Pulmonary hypertension – elevated BP in the pulmonary circuit. Increases its afterload that influences SV (decreases)

Cardiac tamponade

Occurs due to Pericarditis
- inflammation of pericardium
Heart is compressed by fluids that leak into pericardial cavity.

Symptoms:
- pain (deep to sternum).
- creaking sound heard with stethoscope
Regulation of Stroke Volume

Contractility: contractile strength at a given muscle length, independent of muscle stretch and EDV

I. Positive inotropic agents increase contractility
   - Increased Ca\(^{2+}\) influx due to sympathetic stimulation
   - Hormones (thyroxine, glucagon, and epinephrine)

II. Negative inotropic agents decrease contractility
   - Acidosis
   - Increased extracellular K\(^{+}\)
   - Calcium channel blockers

Regulation of Stroke Volume

Preload: degree of stretch of cardiac muscle cells before they contract (Frank-Starling law of heart)
- Cardiac muscle exhibits a length-tension relationship
- At rest, cardiac muscle cells are shorter than optimal length
- Slow heartbeat and exercise increase venous return
- Increased venous return distends (stretches) the ventricles and increases contraction force

Regulation of Stroke Volume

Afterload: pressure that must be overcome for ventricles to eject blood

Role of Hypertension
- Increases afterload, resulting in increased ESV and reduced SV → decreased C.O.
- Heart has to work harder to keep up!!!