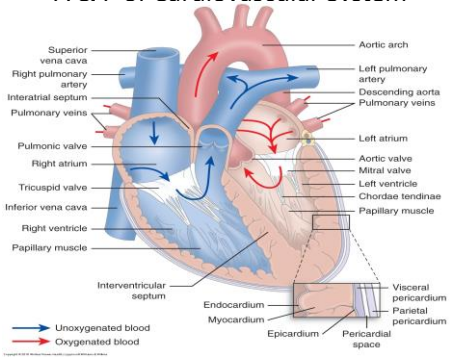
Cardiovascular Assessment

Dr. Rexi Thomas

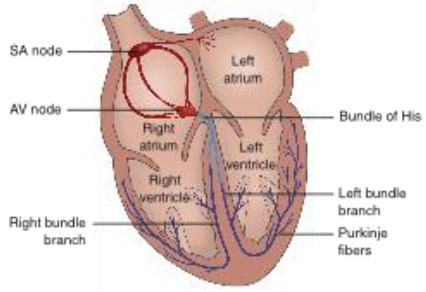
Overview of Anatomy and Physiology

- Three layers: endocardium, myocardium, epicardium
- Four chambers: Right atrium and ventricle, left atrium and ventricle
- Atrioventricular valves: tricuspid and mitral
- Semilunar valves: aortic and pulmonic
- Coronary arteries
- Cardiac conduction system (electrophysiology)
- Cardiac hemodynamics

A & P of Cardiovascular Svstem

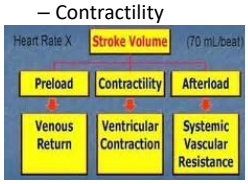


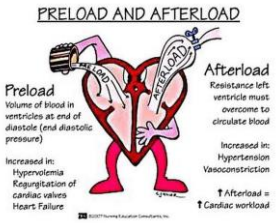
Cardiac Conduction System: Electrophysiology



Cardiac Output

- Stroke volume x heart rate
- Stroke Volume
  - Preload
  - Afterload
  - Contractility





Cardiac Output #1

- Ejection fraction: percent of end diastolic volume ejected with each heart beat (left ventricle)
- Cardiac output (CO): amount of blood pumped by ventricle in liters per minute
- CO = SV × HR

Cardiac Output #2

- Stroke volume (SV): amount of blood ejected with each heartbeat
  - Preload: degree of stretch of cardiac muscle fibers at end of diastole
  - Afterload: resistance to ejection of blood from ventricle
  - Contractility: ability of cardiac muscle to shorten in response to electrical impulse

Influencing Factors

- Control of heart rate
  - Autonomic nervous system, baroreceptors
- Control of stroke volume
  - Preload: Frank–Starling Law
  - Afterload: affected by systemic vascular resistance, pulmonary vascular resistance

Contractility

- Contractility increased by catecholamines, SNS, certain medications
- Increased contractility results in increased stroke volume
- Decreased by hypoxemia, acidosis, certain medications

Assessment

- Color
- Mucous membranes
  - Jugular vein distention
- Capillary refill
- Heart
  - Valves
  - Murmur
  - Pulse deficit
  - Pulse pressure
  - Cardiac output
  - Stroke Volume
- Peripheral pulses
  - Carotid
  - Apical
  - Brachial
  - Radial
  - Ulnar
  - Femoral
  - Popliteal
  - Posterior tibial
  - Dorsalis pedis
- Edema
  - Pitting/ non-pitting

Laboratory Tests

- Cholesterol
- High Density Lipoproteins (HDL)
- Low Density Lipoproteins (LDL)
- Triglycerides
- Cardiac Enzymes
  - CPK, CK-MB, troponin
- Brain type Natriuretic Peptide (BNP)
- C- Reactive Protein
- D-dimer
- Homocysteine levels

Diagnostic Tests

- CXR
- Electrocardiography (ECG)
- Cardiac Stress Testing
  - Exercise
  - Pharmacological
- Echocardiogram/ TEE
- Cardiac Catheterization
  - Angiography

Electrocardiography

- 12-lead ECG
- Continuous monitoring
  - Hardwire
  - Telemetry
  - Lead systems
  - Ambulatory monitoring

Cardiac Stress Testing

- Exercise stress test
  - Patient walks on treadmill with intensity progressing according to protocols
  - ECG, V/S, symptoms monitored
  - Terminated when target HR is achieved
- Pharmacologic stress testing
  - Vasodilating agents given to mimic exercise

Diagnostic Tests

- Radionuclide imaging:
  - Myocardial perfusion imaging
  - Positron emission tomography
  - Test of ventricular function, wall motion
  - Computed tomography
  - Magnetic resonance angiography

Echocardiography

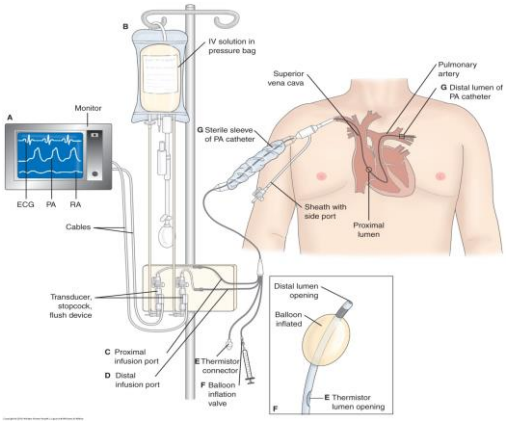
- Noninvasive ultrasound test that is used to:
  - Measure the ejection fraction
  - Examine the size, shape, and motion of cardiac structures
- Transthoracic
- Transesophageal

Cardiac Catheterization

- Invasive procedure used to diagnose structural and functional diseases of the heart and great vessels
- Right heart catheterization
  - Pulmonary artery pressure and oxygen saturations may be obtained; biopsy of myocardial tissue may be obtained
- Left heart catheterization
  - Involves use of contrast agent

Hemodynamic Monitoring

- Central Venous Pressure Monitoring
- Pulmonary Artery Pressure Monitoring
- Intra-arterial Blood Pressure Monitoring


B
IV solution in pressure bag
Monitor
A
ECG
PA
RA
Cables
Transducer, stopcock, flush device
C Proximal infusion port
D Distal infusion port
E Thermistor connector
F Balloon inflation valve
G Sterile sleeve of PA catheter
Superior vena cava
Pulmonary artery
G Distal lumen of PA catheter
Sheath with side port
Proximal lumen
Distal lumen opening
Balloon inflated
E Thermistor lumen opening
F