Mediastinum is the central compartment of the thoracic cavity. It contains the heart, the great vessels of the heart, the esophagus, the trachea, the phrenic nerve, the cardiac nerve, the thoracic duct, the thymus, and the lymph nodes of the central chest.

Cardiopulmonary Resuscitation compresses heart between sternum and backbone.
**Visceral and Parietal Pericardium**

- Visceral Pericardium adheres to heart itself
- Parietal adheres to thoracic cavity wall
- Pericardial cavity in between filled with pericardial fluid, which serves to protect and lubricate, minimize friction

**Pericarditis** = inflammation of pericardium, rubbing and irritation

**Pericardial Tamponade** – tears in pericardium ➞ blood enters space, precludes heart expansion due to blood in pericardial sac pushing on heart, preventing it from expansion

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**Heart Layers**

- Outer covering: Epicardium or visceral pericardium
- Inner covering: smooth endocardium is continuous with endothelium lining blood vessel
- **MYOCARDIUM** = cardiac muscle cells
Cardiac Muscle in myocardium

- Hybrid of Skeletal and Smooth muscle
  - Inherent rhythmicity
    - Put in dish at right temperature and nutrients, will beat forever
  - Muscle in upper and lower chambers are is separate from one another
    - Atrium (waiting chamber) ➔ Ventricule (pumping chamber)
  - Pumps to >50,000 miles of vessels = 2+x around earth
  - Two pumping systems working together ➔ dual pumps working simulataeously
    - Right heart = pulmonary circuit
    - Left heart = systemic circuit

Embryology
• Left Heart (systemic pump)
  – Thicker ventricular wall
  – Pumps at higher pressure
  – 120 mmHg systole*, 80 mmHg diastole**

• Right Heart (pulmonary pump)
  – Thinner ventricular wall
  – Pumps at lower pressure
  – 20 mmHg systole*, 15 mmHg diastole**

*systole = contraction & pumping blood
** diastole = relaxation & filling with blood
Upper and Lower Heart Chambers

Blood flow through all chambers per unit time is equivalent – closed circuit, no place to add or lose blood

(a) Blood flow through the heart

To systemic circulation (upper body)
- Aorta
- Right and left pulmonary arteries (to lungs)
- Left pulmonary veins (return blood from left lung)
- Left atrium
- Aortic semilunar valve (shown open)
- Left atrioventricular valve (shown open)
- Left ventricle
- Septum

KEY
- O₂-rich blood
- O₂-poor blood

To systemic circulation (lower body)
- Superior vena cava (returns blood from head, upper limbs)
- Right pulmonary veins (return blood from right lung)
- Pulmonary semilunar valve (shown open)
- Right atrium
- Right atrioventricular valve (shown open)
- Right ventricle
- Inferior vena cava (returns blood from trunk, legs)
RT HRT = Low pressure circuit

LT HRT = high pressure circuit

= 120 mmHg during systole
= 80 mmHg during diastole

4 valves control direct flow; no flow between chambers other than through valves
Chordae Tendonae: prevent valve inversion

Papillary Muscles: contract to prevent inversion
Open / Close Valves, due to differences in pressure from side to side of valve, assisted by chords and papillary muscles

Open

Close

Open / Close Valves, due to differences in pressure from side to side of valve, assisted by chords and papillary muscles
Damage to valves causes abnormal flow

- Too tight = don’t open = stenosis
- Too loose = irregular = insufficient closure and inefficiency of contraction because valve leaks
  - Alter contraction force, speed necessary to pump sufficiently
Myocardial Blood Supply: nourishment of myocardium

Anastamosis: joining of sets blood vessels connected – many anastomoses in coronary circulation – evolution of best nutritional supply to contracting myocardium
• Narrowing or blockage of O2 rich blood flow in coronary arteries = coronary occlusion = problems with sufficient oxidative phosphorylation to allow myocardial contraction

• Venous Drainage
  – Parallel vessels
  – Rarely a problem
  – Drain directly to right atrium
    • Little Hb-O2 left

Heart Conduction System

1% of cardiac contractile cells lose contractile machinery, change membrane gates, become “cardiac conducting system cells”

Coordinates heart beats
  – ventricle spontaneously active about 20-30 times per minute
  – nodal tissue, conducting tissue has evolved to be faster
Conduction System

- Sinoatrial (SA) Node
- Atrioventricular (AV) Node
- Interatrial pathway
- A-V bundle
- Bundle Branches (Branches of His)
- Perkinje Fibers