MEDIASTINUM, HEART, AND GREAT VESSELS

Objectives
1. To understand and identify regions of the mediastinum
2. To understand key developmental aspects of the heart and circulatory system
3. To understand the basic anatomy of the heart, its blood supply and drainage, and the relationships of the great vessels in the superior mediastinum.

Mediastinum
1. The area between the two pleural sacs
2. Subdivided into:
   a) Superior mediastinum - contains the aortic arch and its 3 branches, SVC, trachea, esophagus, phrenic and vagus nerves, and thymus
   b) Middle mediastinum - contains the heart and pericardium
   c) Posterior mediastinum - contains the thoracic portion of the descending aorta, azygos and hemiazygos veins, thoracic duct, and esophagus with associated vagal trunks

Development of the Circulatory System
A. Heart and Great Vessels
1. Partitioning of the atrioventricular canal and primitive atrium and ventricle begins around the
middle of 4th week and is completed by the end of the 5th week

2. A series of processes will transform the embryonic heart from a simple tube to a four-chamber structure
   a) Partitioning of the atrioventricular canal by the endocardial cushions

   ![Diagram of atrioventricular canal partitioning]

   b) Partitioning of the primitive ventricle by an interventricular septum

   ![Diagram of interventricular septum]

   c) Partitioning of the primitive atrium by the septum primum and septum secundum

   ![Diagram of atrial septal defect]

3. Atrial septal defect (ASD) is a common type of congenital heart malformation. A patent foramen ovale is the most common form of ASD.
B. Circulatory System
1. Fetal Circulation
   - has 3 blood shunts: ductus venosus, foramen ovale, and ductus arteriosus
2. Adult Circulation
   - blood shunts close at birth to form the remnant structures ligamentum venosum, fossa ovalis, and ligamentum arteriosum
**Pericardium**

**A. Layers**

1. **Fibrous Pericardium**
   
a) tough fibrous outer sac  
b) encloses the heart and proximal ends of the great vessels  
c) attachments  
   i. anteriorly to manubrium, sternum, xiphoid process - sternopericardial ligaments  
   ii. posteriorly to structures in the posterior mediastinum (such as the oesophagus) by loose connective tissue  
   iii. superiorly continuous with adventitia of great vessels  
   iv. inferiorly to diaphragm via ligamentous extensions - pericardiacophrenic ligament  

2. **Serous Pericardium**
   
a) divided into 2 layers  
   i. parietal - lines the inside of the fibrous pericardium (appears fused to it)  
   ii. visceral (epicardium) - intimate contact with heart tissue  
   b) pericardial cavity - space between the two serous layers

**B. Pericardial Reflections**

1. **Transverse Sinus**
   
a) lies posterior to the ascending aorta and pulmonary trunk  
   b) anterior to the superior vena cava  

2. **Oblique Sinus**
   
a) blind recess posterior to the heart
Heart

1. right brachiocephalic vein
2. left brachiocephalic vein
3. superior vena cava (SVC)
4. inferior vena cava (IVC)
5. azygos vein
6. aortic arch - T4
7. brachiocephalic trunk
8. left common carotid artery

9. left subclavian artery
10. pulmonary trunk and arteries
11. pulmonary veins
12. right atrium
13. right ventricle
14. left atrium
15. left ventricle
A. Great Vessels in Superior Mediastinum

1. aortic arch (AR)  
2. ascending aorta (AA)  
3. descending aorta (DA)  
4. brachiocephalic trunk (BT)  
5. right subclavian artery (RS)  
6. right common carotid artery (RC)  
7. left common carotid artery (LC)  
8. left subclavian artery (LS)  

B. Internal Structure of the Heart

1. Right Atrium  
   a) sinus venarum - smooth part of the posterior inner wall  
   b) auricle  
      i. atrial appendage  
      ii. contains pectinate mm. - rough part of the internal wall  
      iii. crista terminalis  
         - site of pectinate mm. termination  
         - apex is site of sinuatrial node (pacemaker)  
   c) openings  
      i. superior vena cava  
      ii. inferior vena cava  
      iii. coronary sinus  
      iv. venae cordae minimae  
      v. right atrioventricular valve (tricuspid valve)
d) interatrial septum
   i. fossa ovalis - remnant of the foramen ovale (embryological structure)
   ii. atrial septal defect
       - failure of the foramen to close during development of heart
       - allows oxygenated blood from left atrium to enter right atrium
       - leads to enlargement of right atrium and ventricle and dilation of pulmonary trunk

2. Right Ventricle
   a) papillary mm.
      i. arise from the ventricular wall
      ii. attach to the leaflets of the tricuspid valve via the chordae tendinae
      iii. prevents collapse of the valve cusps into the atrium during ventricular systole
   b) trabeculae carneae
      i. irregular muscular elevations projecting from the ventricular walls
      ii. septomarginal band trabecula (moderator band)
          - a prominent trabecula that crosses the cavity from the septum to the base of the anterior papillary m.
          - part of the conducting system of the heart
   c) pulmonary valve
      i. three sumilunar cusps - anterior, left, and right

3. Left Atrium
   a) openings
      i. pulmonary veins - 2 superior and 2 inferior
      ii. left atrioventricular valve (bicuspid or mitral valve)
   b) auricle
   c) directly anterior to the oesophagus

4. Left Ventricle
   a) thick-walled with finer and more numerous trabeculae carneae
   b) papillary mm. - anterior and posterior
   c) chordae tendinae
   d) atrioventricular valve (mitral valve)
   e) aortic valve - posterior (non-coronary), left and right (coronary) cusps
5. Circulation of Blood through the Heart Chambers
right atrium (deoxygenated blood) → tricuspid valve → right ventricle → pulmonary valve → pulmonary trunk → pulmonary arteries → lungs → pulmonary veins → left atrium (oxygenated blood) → mitral valve → left ventricle → aortic valve → ascending aorta → aortic arch → descending aorta → body tissues → venous system → superior and inferior vena cavae → right atrium

C. Heart Valves

Aortic/Pulmonary valve

Atrioventricular valve
D. Coronary Circulation
1. Arterial Supply

Right coronary dominance

Left coronary dominance

1. right coronary artery
2. left coronary artery
3. circumflex artery
4. anterior interventricular artery
5. posterior interventricular artery

Note: Occlusion by an embolus or reduction of the lumen due to atherosclerosis of a coronary artery or one of its branches can lead to a myocardial infarct (necrosis of the heart muscle).

2. Venous Drainage
   - mainly by the cardiac veins and the coronary sinus