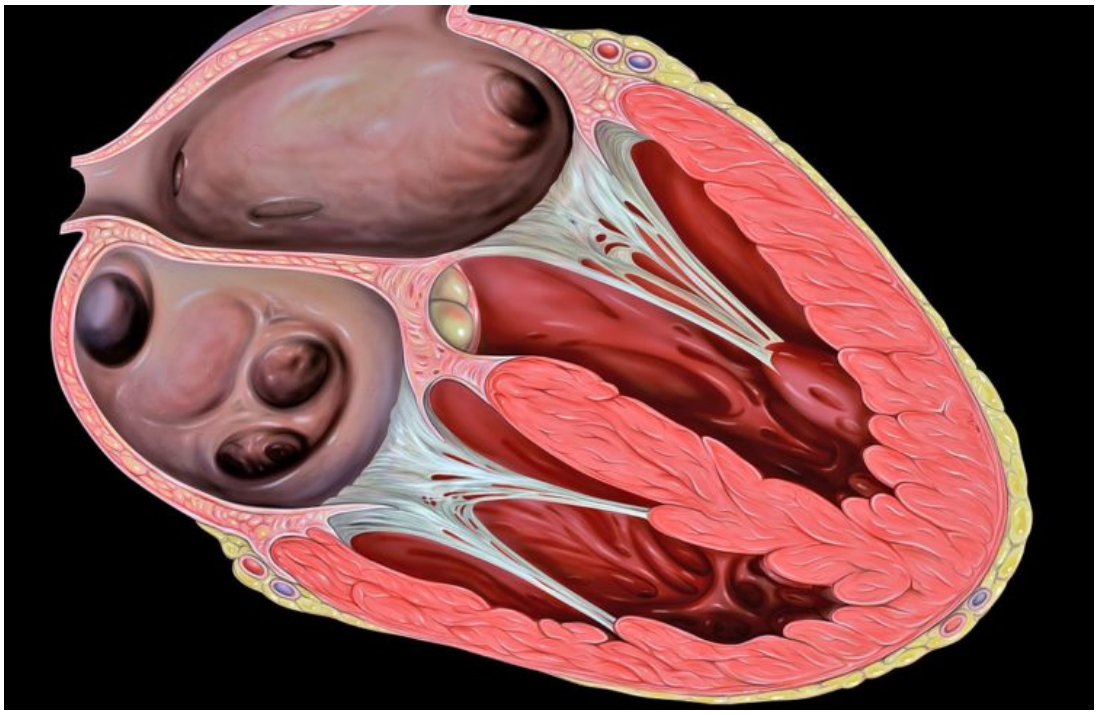
Chambers and Great Vessels of the Heart

See online here

The heart performs the function of receiving and pumping blood. In order to perform this function, it has 4 compartments, or chambers – the 2 atria and the 2 ventricles. The left atrium receives oxygen-rich blood from the pulmonary circulation and drains it into the left ventricle, which then pumps it to the rest of the body. The right atrium receives oxygen-poor blood from the systemic circulation and drains it into the right ventricle, which then sends it to the pulmonary circulation for oxygenation.



Chambers of the Heart

Atria

The atria are located on the anterior aspect of the heart and **receive blood**. The superior and inferior **vena cava** transport oxygen-poor blood from the **systemic circulation** to the **right atrium**, which then pumps it into the **right ventricle**.

The left and right **pulmonary veins** transport oxygen-rich blood from the **pulmonary circulation** to the **left atrium**, which then sends it across the **mitral valve** to the **left ventricle**.

The atria receive blood passively, i.e. the blood does not traverse through any valves. During **atrial diastole** (relaxation), the atria dilate and are filled with blood, and during **atrial systole** (or contraction) they pump the blood into the ventricles. The atria

promote a continuous flow of venous blood as there are:

- **No atrial valves**
- Contractions during atrial systole are **incomplete**, thereby allowing venous blood to flow uninterruptedly
- Atrial contractions are **mild**, there is no backpressure to prevent venous blood flow
- Atrial diastole begins **prior** to the start of the ventricular systole

Ventricles

The 2 ventricles of the heart are situated on its posterior aspect, below their corresponding atrium. The **left atrium** pumps oxygen-rich blood to the **left ventricle** during **diastole**. The left ventricle then pumps the blood into the **aorta**, which branches to direct blood to the **systemic circulation**.

The **right atrium** pumps oxygen-poor blood into the **right ventricle**, which then transports it via the **pulmonary artery** to the **pulmonary circulation** for oxygenation.

The **tricuspid valve** separates the right atrium and right ventricle, while the **mitral valve** separates the left atrium and ventricle. The valves are attached to the **chordae tendineae**, which are elastic tendons that open the valve during atrial systole/ventricular diastole and close the valve during ventricular systole preventing regurgitation of blood.

The **ventricles** have thicker, more muscular walls compared to the atria, where the left ventricle has thicker walls compared to the right ventricle. There are **semilunar valves** at the opening to the **aorta** and the **pulmonary artery**. These valves close during ventricular diastole and separate the left ventricle from the aorta and the right ventricle from the pulmonary artery, thus preventing regurgitation of blood.

The volume of blood pumped by the left ventricle to the systemic circulation is larger compared to the volume of blood pumped by the right ventricle to the pulmonary circulation.

Great Vessels of the Heart

The great vessels of the heart are all located in the **mediastinum**. They help to transport blood between the heart and the rest of the body. There are **5 great vessels**, which enter and leave the heart. These are the **superior and inferior vena cava**, which directs oxygen-poor blood to the heart, the **aorta**, which carries oxygen-rich blood from the heart, the **pulmonary artery,** and the **pulmonary vein**.

Superior vena cava

The superior vena cava is a large vein, which directs **oxygen-poor blood** from the upper arms, and head-neck region to the **right atrium**. The merger of the **brachiocephalic veins** posterior to the meeting point of the **1st costal cartilage** and the **sternum** leads to the formation of the superior vena cava.

The 2 **brachiocephalic veins** themselves are formed when the **internal jugular and subclavian veins** merge. The **thoracic duct** drains into the **left subclavian vein** on the left side of the body. The superior vena cava also **recirculates lymph**.

Inferior vena cava

The inferior vena cava is a large vein that directs **oxygen-poor blood** from the lower limbs, pelvis, and torso to the **right atrium**. It is formed when the **right and the left common iliac veins** merge at the L5 vertebral level.

The inferior vena cava ascends along with the abdominal aorta and then passes through the **diaphragmatic caval hiatus** at the T8 vertebral level. The **right gonadal, right suprarenal vein**, the **left renal vein,** and all the **lumbar, hepatic and phrenic veins** drain into the inferior vena cava.

Pulmonary arteries

The pulmonary arteries are responsible for transporting **oxygen-poor blood** from the **right ventricle** for oxygenation to the **pulmonary alveolar capillaries**. The right ventricle transports blood across the **semilunar valve** into the **solitary pulmonary trunk**, which subsequently separates into the **right and left pulmonary arteries** at the T5–T6 level.

The right atrium lies posterolateral to the pulmonary trunk, which overlaps the **aortic root** as it rises superiorly and posteriorly. The left pulmonary artery is shorter and narrower compared to the right pulmonary artery.

Pulmonary veins

The pulmonary veins transport **oxygen-rich blood** to the **left atrium** from the pulmonary circulation. The function is carried out by 4 veins. The **superior pulmonary veins** carry blood from the **superior pulmonary lobes,** while the **inferior pulmonary veins** carry blood from the **inferior pulmonary lobes**.

The **superior vena cava** and the **right atrium** lie anterior to the **right pulmonary veins,** while the **descending thoracic aorta** lies posterior to the **left pulmonary veins**.

Aorta

The aorta carries **oxygen-rich blood** to the **entire body** from the **left ventricle**. The left ventricle transports blood across the **semilunar aortic valve** into the **ascending part of the aorta**, which then continues as the **aortic arch**, then as the **thoracic aorta** and finally terminates as the **abdominal aorta** at the L4 vertebral level.

Ascending aorta

The ascending aorta is 5 cm (2 in) in length and travels in the **pericardial sheath** along with the pulmonary trunk. It has the **right and left aortic dilatations or sinuses** near the **aortic valve**. These give rise to the **right and left coronary arteries**.

Aortic arch

The **2nd intercostal joint** is the landmark where the ascending aorta continues as the aortic arch, which then travels posterosuperiorly and then inferiorly. Subsequently, it descends in the **posterior mediastinum** on the left side of the midline. At the T4 vertebral level, the aortic arch becomes the **thoracic aorta**.

The aortic arch gives off the following branches: the **right brachiocephalic trunk,** the

left common carotid artery and the **left subclavian artery**.

Thoracic aorta

This begins on the **left side of the midline** as a continuation of the aortic arch and runs from T4 to T12 vertebra. As it nears the **aortic hiatus** in the **diaphragm**, it lies near the midline. It gives off the following branches: bronchial, mediastinal, esophageal, pericardial, superior phrenic, intercostal and subcostal arteries.

Descending abdominal aorta

The thoracic aorta continues as the descending aorta at the **aortic hiatus** in the **diaphragm** at the T12 vertebral level and ends opposite the L4 vertebra. It terminates by branching into the 2 **common iliac arteries**. Its other branches are inferior phrenic arteries, celiac arteries, superior mesenteric artery, middle suprarenal arteries, renal arteries, gonadal arteries, inferior mesenteric artery, median sacral artery, lumbar arteries.

Clinical Relevance

Aortic aneurysm

An aortic aneurysm is a dilatation of the arterial wall more than 50% of its diameter. This can occur in the aorta due to several causes. **Thoracic aortic aneurysms** are usually associated with **Marfan's syndrome** while **abdominal aortic aneurysms** are associated with **atherosclerosis** and **smoking**. If untreated, aneurysms can **rupture**, leading to death.

Dissection of the aorta

Dissection of the aorta refers to a **separation of the layers** of the intima and media of the aortic wall. This causes an **abnormal flow of blood** through 2 parallel channels with **thinning of the vessel walls**. It can subsequently result in the formation of an **aneurysm**.

References

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Heart chambers via medlineplus.gov

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The Aorta via teachmeanatomy.info

Notes