

# ANATOMY

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Thorax

# Thorax

## AREAS

- SUPERIOR MEDIASTINUM
- ANTERIOR MEDIASTINUM
- MIDDLE MEDIASTINUM
- POSTERIOR MEDIASTINUM

## BONES

- RIBS
- STERNUM
- THORACIC SPINE

## MUSCLES

- THORACIC CAGE
- DIAPHRAGM

## ORGANS

- THYMUS GLAND
- MAMMARY GLANDS
- HEART
- LUNGS
- TRACHEOBRONCHIAL TREE
- PLEURAE

## VASCULATURE

- AORTA
- SUPERIOR VENA CAVA



Thorax

## Vasculature

Aorta

Superior Vena Cava

# AORTA

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# Aorta

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# Aorta

## Introduction

- The aorta is the largest artery in the body, initially being an inch wide in diameter. It receives the cardiac output from the left ventricle and supplies the body with oxygenated blood via the systemic circulation.
- The aorta can be divided into four sections: the **ascending aorta**, the **aortic arch**, the **thoracic (descending) aorta** and the **abdominal aorta**. It terminates at the level of L4 by bifurcating into the left and right common iliac arteries. The aorta classified as a large elastic artery.



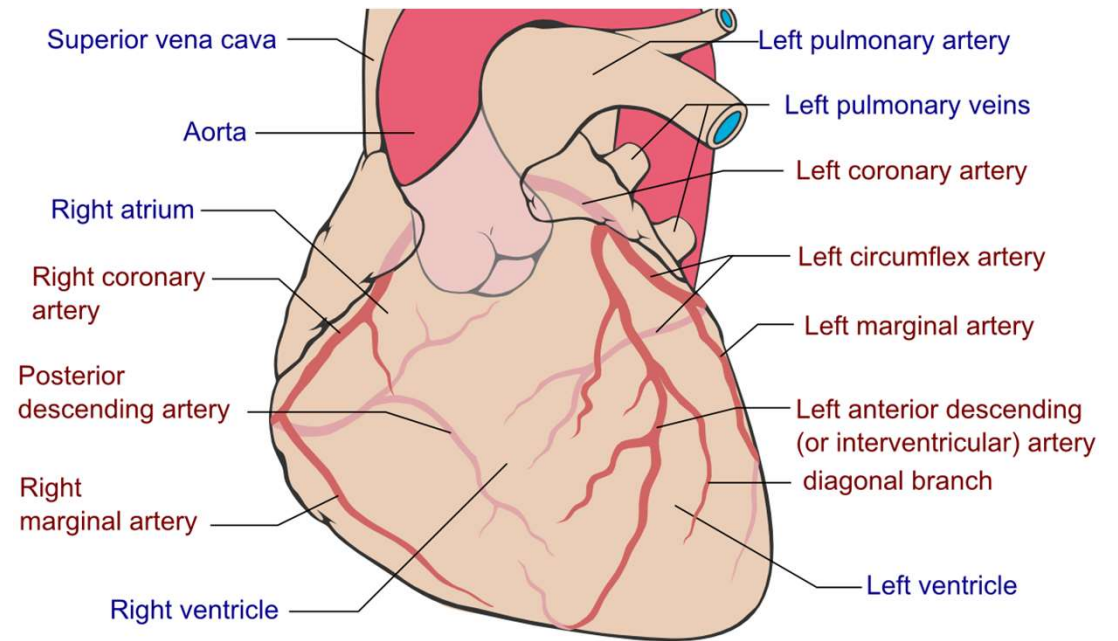
# Aorta

## Ascending Aorta

- The ascending aorta arises from the **aortic orifice** from the left ventricle and ascends to become the aortic arch. It is 2 inches long in length and travels with the pulmonary trunk in the pericardial sheath.
- **Branches**
- The left and right aortic sinuses are dilations in the ascending aorta, located at the level of the aortic valve. They give rise to the **left and right coronary arteries** that supply the myocardium.

# Aorta

## Ascending Aorta Branches







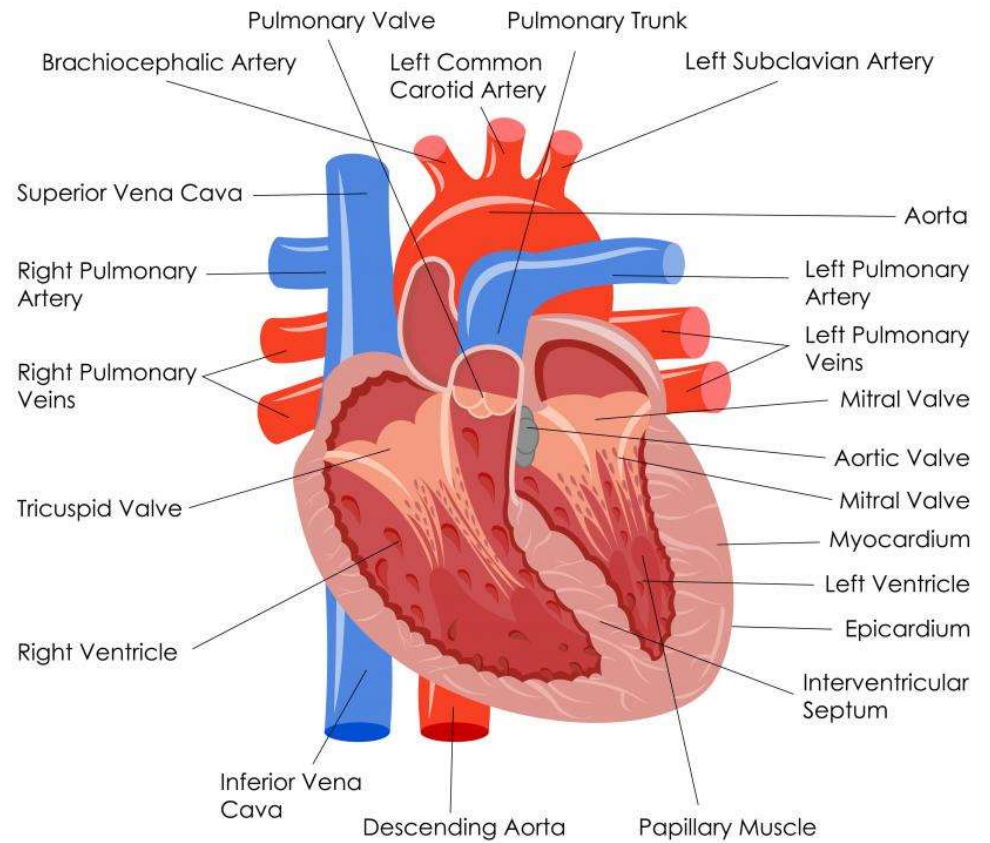
# Aorta

## Aortic Arch

- The aortic arch is a continuation of the ascending aorta and begins at the level of the second sternocostal joint. It arches superiorly, posteriorly and to the left before moving inferiorly.
- The aortic arch ends at the level of the T4 vertebra. The arch is still connected to the pulmonary trunk by the **ligamentum arteriosum** (remnant of the foetal ductus arteriosus).
- Branches
- There are three major branches arising from the aortic arch. Proximal to distal:
  - **Brachiocephalic trunk:** The first and largest branch that ascends laterally to split into the right common carotid and right subclavian arteries. These arteries supply the right side of the head and neck, and the right upper limb.
  - **Left common carotid artery:** Supplies the left side of the head and neck.
  - **Left subclavian artery:** Supplies the left upper limb.

# Aorta

## Aorta Arch Branches



Human Heart

wiseGEEK



# Aorta

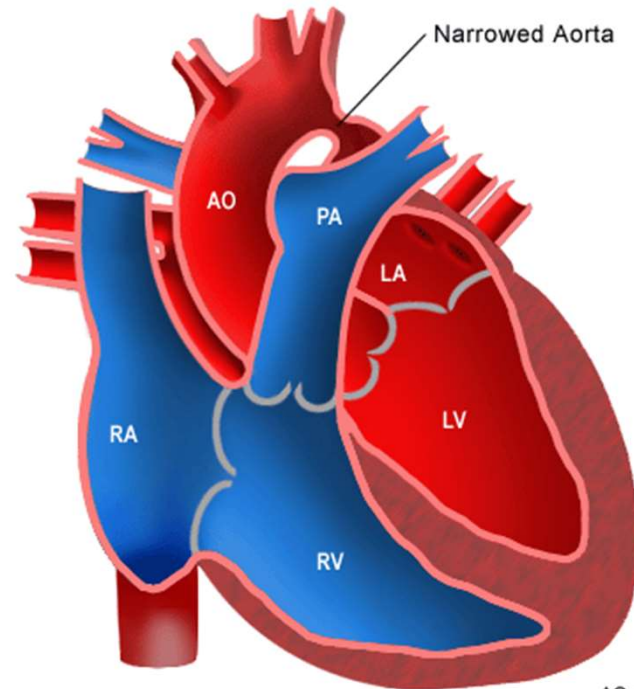
## Clinical Relevance: Coarctation of the Aorta

- Coarctation of the aorta refers to narrowing of the vessel, usually at the insertion of the **ligamentum arteriosum** (former ductus arteriosus). It is a congenital condition. The narrow vessel has an increased resistance to blood flow, which increases the after-load for the left ventricle – leading to left ventricular hypertrophy.
- Blood supply to the head, neck and upper limbs is not compromised as the vessels that supply them emerge proximal to the coarctation. However, blood supply to the rest of the body is reduced. This results in a weak, delayed femoral pulse which presents clinically as **radio-femoral delay**.

Aorta

Clinical Relevance

### Coarctation of the Aorta



■ Oxygen-rich Blood  
■ Oxygen-poor Blood

AO = Aorta  
PA = Pulmonary Artery  
LA = Left Atrium  
RA = Right Atrium  
LV = Left Ventricle  
RV = Right Ventricle



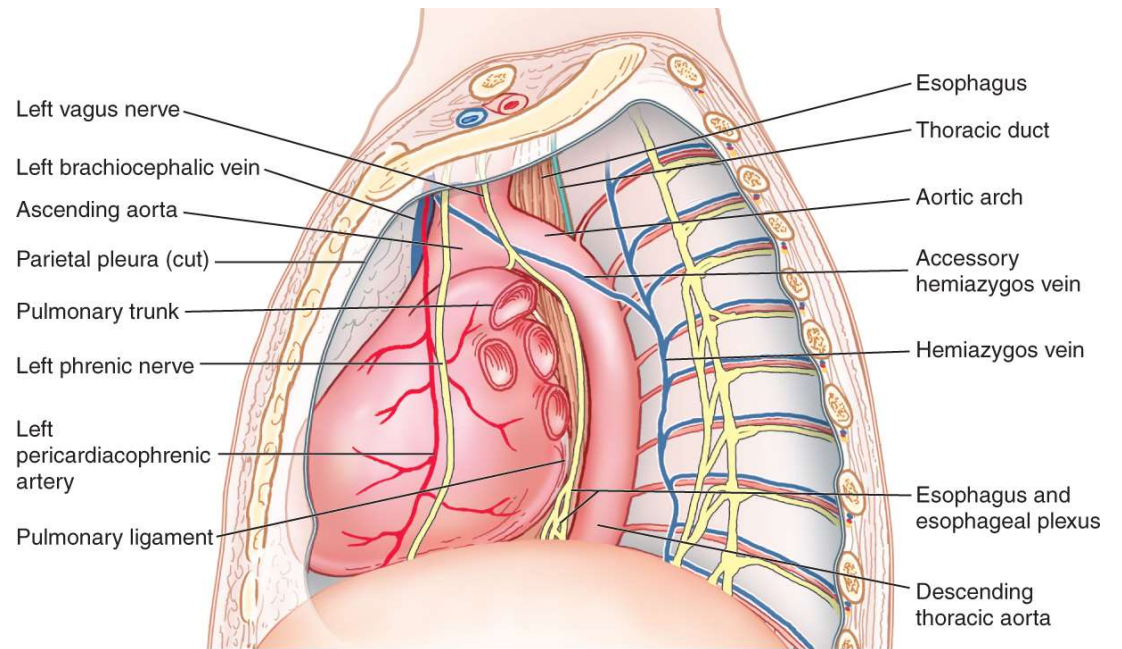
# Aorta

## Thoracic Aorta

- The thoracic (descending) aorta spans from the level of T4 to T12. Continuing from the aortic arch, it initially begins to the left of the vertebral column but approaches the midline as it descends. It leaves the thorax via the **aortic hiatus** in the diaphragm, and becomes the abdominal aorta.

# Aorta

## Thoracic Aorta



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# Aorta

## Thoracic Aorta

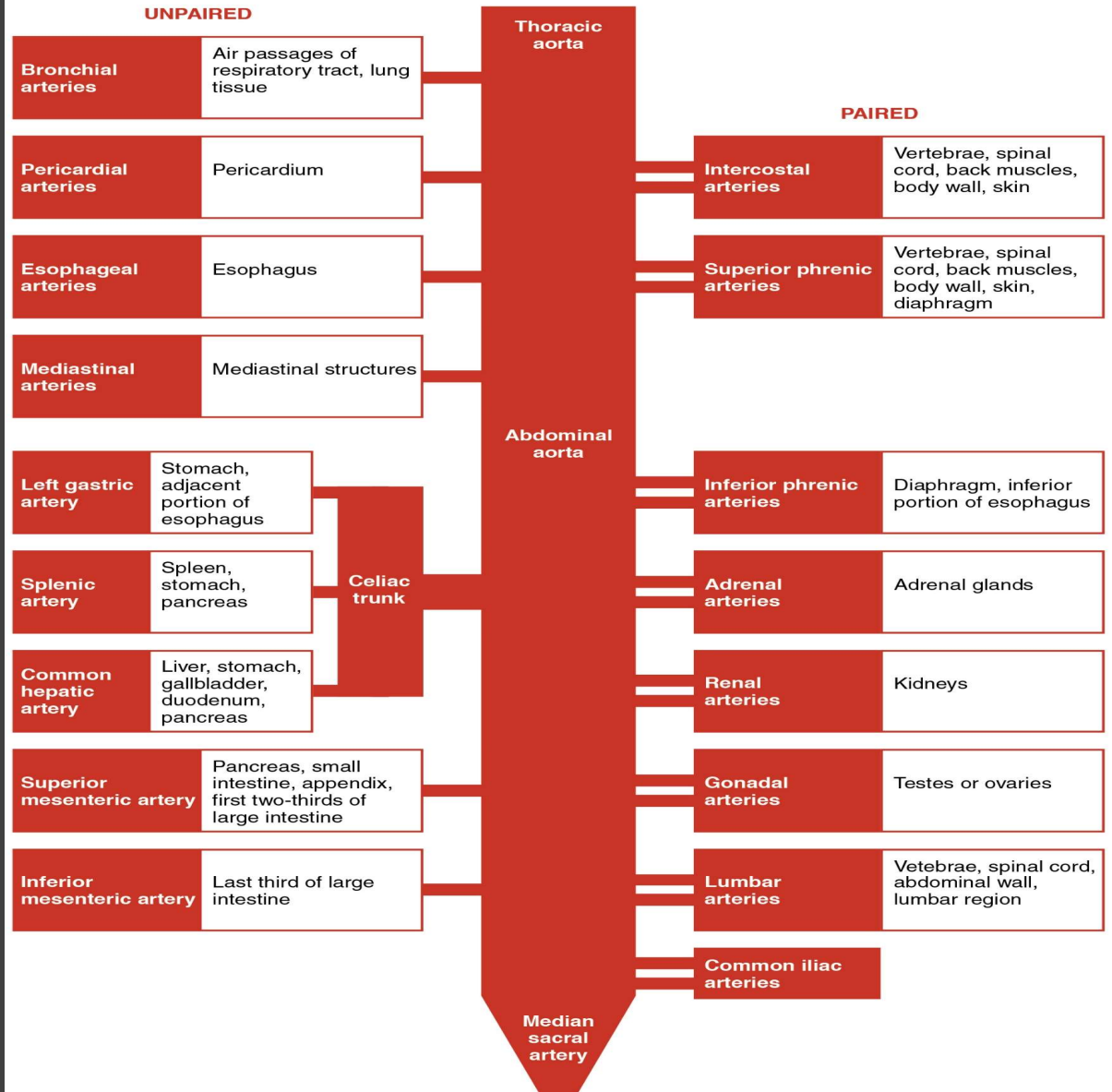
### Branches

In descending order:

- **Bronchial arteries:** Paired visceral branches arising laterally to supply [bronchial](#) and peribronchial tissue and visceral pleura. However, most commonly, only the paired left bronchial artery arises directly from the aorta whilst the right branches off usually from the third posterior intercostal artery.
- **Mediastinal arteries:** Small arteries that supply the lymph glands and loose areolar tissue in the [posterior mediastinum](#).
- **Oesophageal arteries:** Unpaired visceral branches arising anteriorly to supply the [oesophagus](#).
- **Pericardial arteries:** Small unpaired arteries that arise anteriorly to supply the dorsal portion of the [pericardium](#).
- **Superior phrenic arteries:** Paired parietal branches that supply the superior portion of the [diaphragm](#).
- **Intercostal and subcostal arteries:** Small paired arteries that branch off throughout the length of the posterior thoracic aorta. The 9 pairs of intercostal arteries supply the intercostal spaces, with the exception of the first and second (they are supplied by a branch from the subclavian artery). The subcostal arteries supply the flat abdominal wall muscles.

# Aorta

## Branches







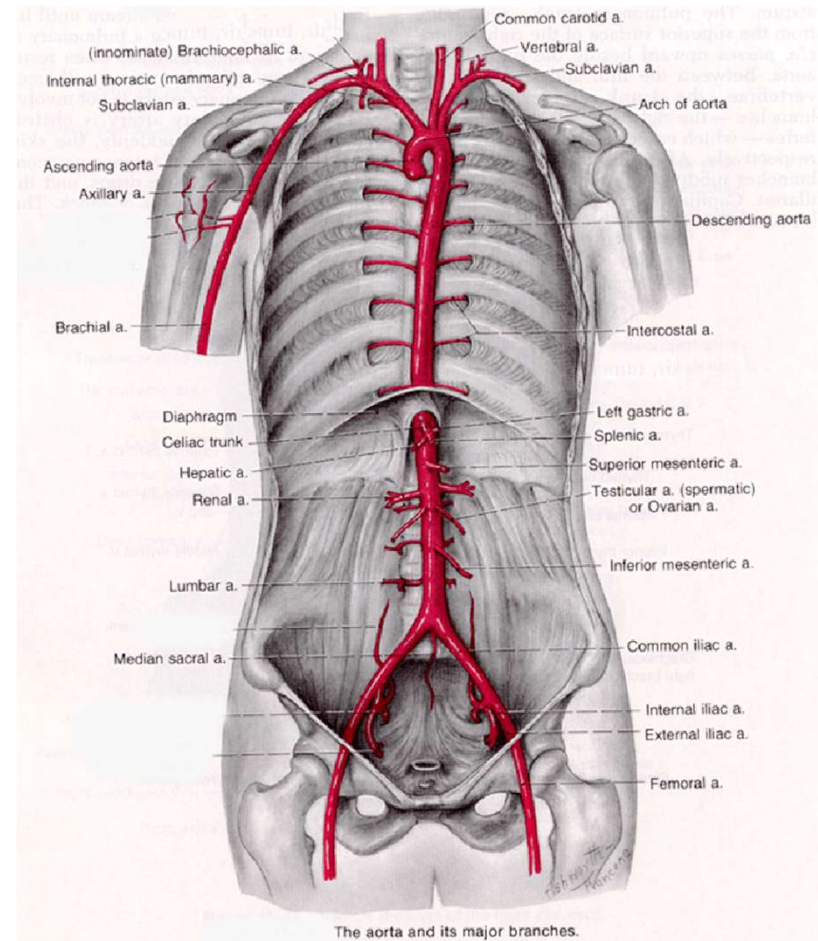
Aorta

### **Abdominal Aorta**

- The abdominal aorta is a continuation of the thoracic aorta beginning at the level of the T12 vertebrae. It is approximately 13cm long and ends at the level of the L4 vertebra. At this level, the aorta terminates by bifurcating into the **right and left common iliac arteries** that supply the lower body.

# Aorta

## Abdominal Aorta



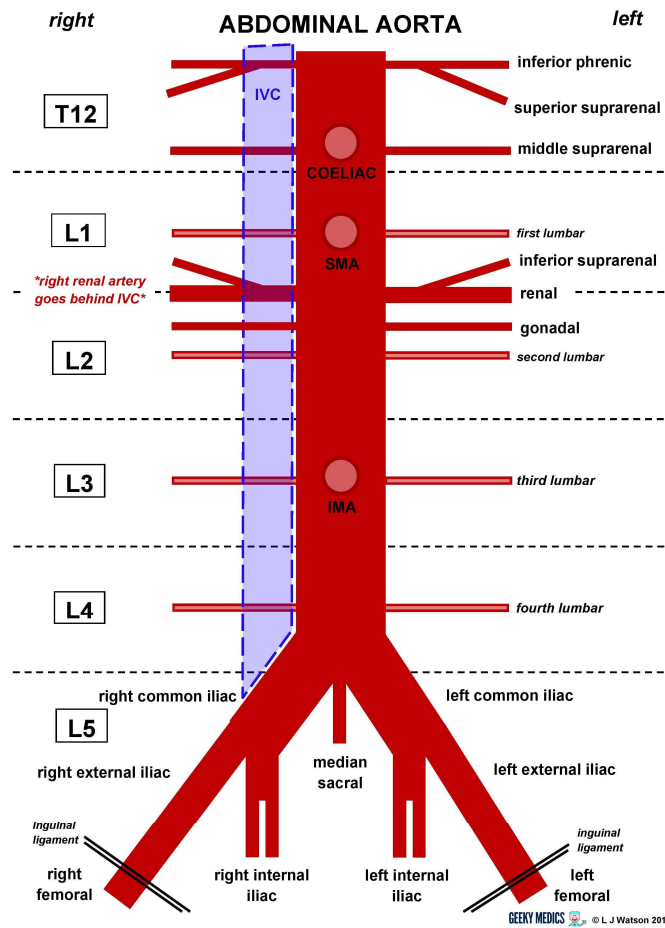
# Aorta

## Abdominal Aorta

- Branches
- In descending order:
- **Inferior phrenic arteries:** Paired parietal arteries arising posteriorly at the level of **T12**. They supply the diaphragm.
- **Coeliac artery:** A large, unpaired visceral artery arising anteriorly at the level of **T12**. It is also known as the celiac trunk and supplies the liver, stomach, abdominal oesophagus, spleen, the superior duodenum and the superior pancreas.
- **Superior mesenteric artery:** A large, unpaired visceral artery arising anteriorly, just below the coeliac artery. It supplies the distal duodenum, jejunum-ileum, ascending colon and part of the transverse colon. It arises at the **lower level of L1**.
- **Middle suprarenal arteries:** Small paired visceral arteries that arise either side posteriorly at the level of **L1** to supply the [adrenal glands](#).
- **Renal arteries:** Paired visceral arteries that arise laterally at the level **between L1 and L2**. They supply the [kidneys](#).

Aorta

Abdominal Aorta





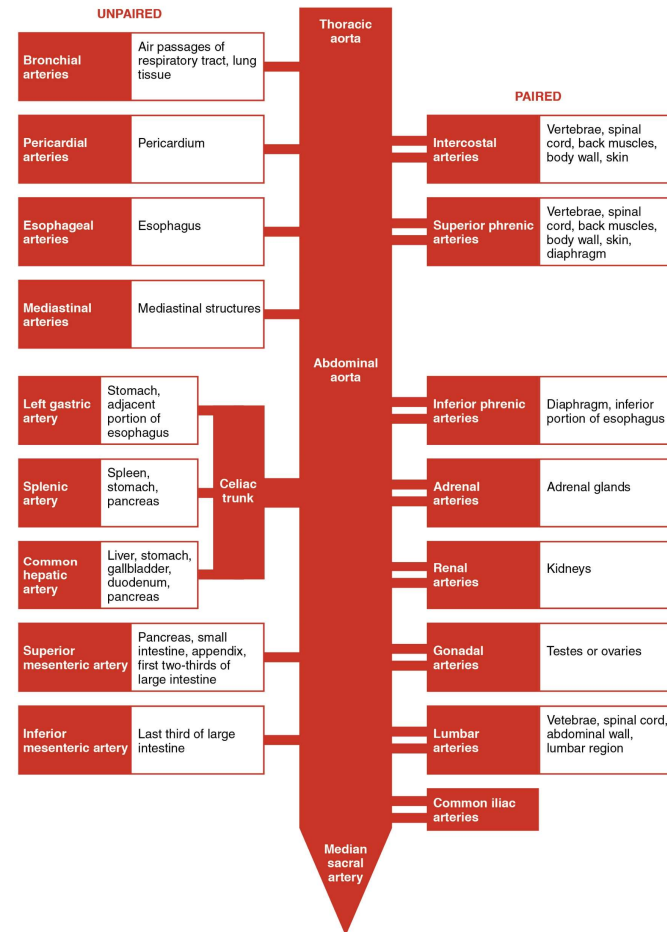
# Aorta

## Abdominal aorta

- **Branches**
- **Gonadal arteries:** Paired visceral arteries that arise laterally at the level of **L2**. Note that the male gonadal artery is referred to as the [testicular](#) artery and in females, the [ovarian](#) artery.
- **Inferior mesenteric artery:** A large, unpaired visceral artery that arises anteriorly at the level of **L3**. It supplies the large intestine from the splenic flexure to the upper part of the rectum.
- **Median sacral artery:** An unpaired parietal artery that arises posteriorly at the level of **L4** to supply the [coccyx](#), [lumbar vertebrae](#) and the [sacrum](#).
- **Lumbar arteries:** There are four pairs of parietal lumbar arteries that arise posterolaterally between the levels of **L1** and **L4** to supply the abdominal wall and [spinal cord](#)

# Aorta

## Branches of Aorta





# Aorta

## Clinical Relevance

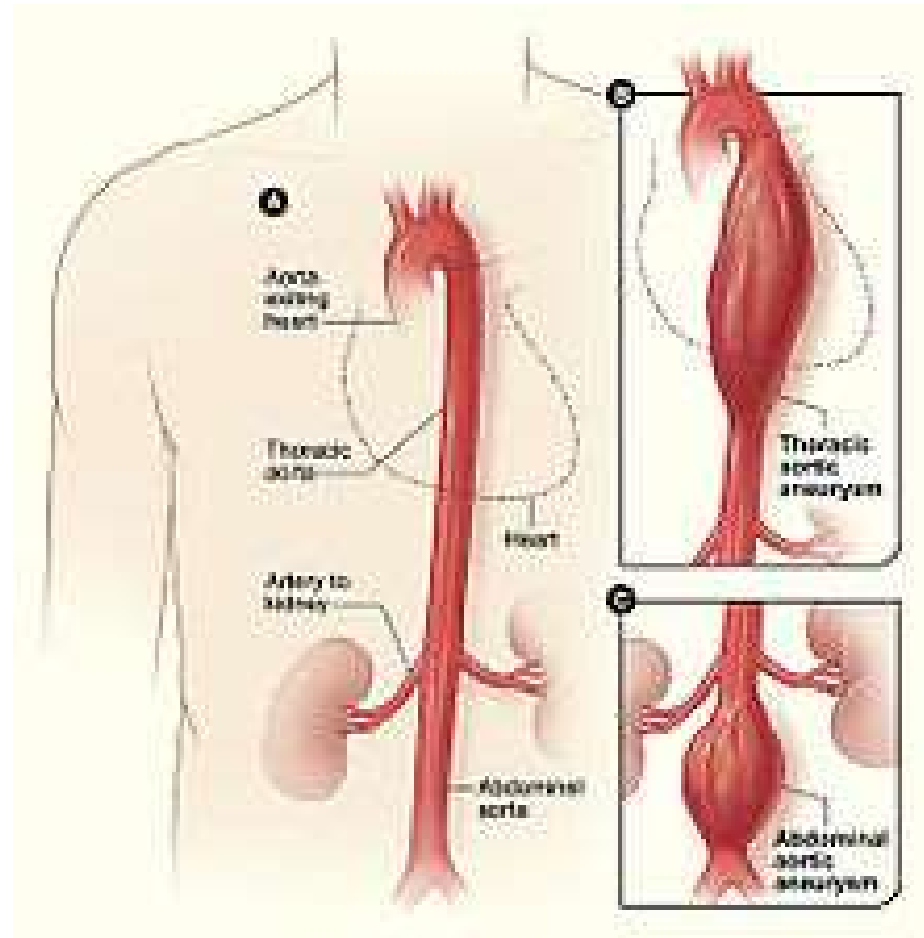
[Aortic aneurysm](#) describes a dilation of the artery to more than **1.5** times its original size. The **abdominal** component of the aorta is the most common site for aneurysmal changes.

Patients suffering with an abdominal aortic aneurysm may experience abdominal pulsations, abdominal pain and back pain. The aneurysm may also compress **nerve roots** causing pain/numbness in the lower limbs. A patient with an aortic arch aneurysm may have a hoarse voice due to the dilation stretching the **left recurrent laryngeal nerve**. Patients may also not have any symptoms at all.

Small aortic aneurysms do not usually pose a serious immediate threat. Diagnosis is made from an ultrasound and the weakened vessel wall can be surgically replaced with a piece of synthetic tubing. If left untreated, a large aneurysm can **rupture**. This is a medical emergency and often fatal.

# Aorta

## Aortic Aneurysm





# Thorax

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Vasculature of Thorax

# Vasculature of Thorax

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Superior Vena Cava

# Superior Vena Cava

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1.1 Clinical Relevance: Jugular Venous Pressure

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2.1 Clinical Relevance: Superior Vena Cava Obstruction

# Superior Vena Cava

The **superior vena cava** (SVC) is a large, valveless vein that conveys venous blood from the upper half of the body and returns it to the right atrium.

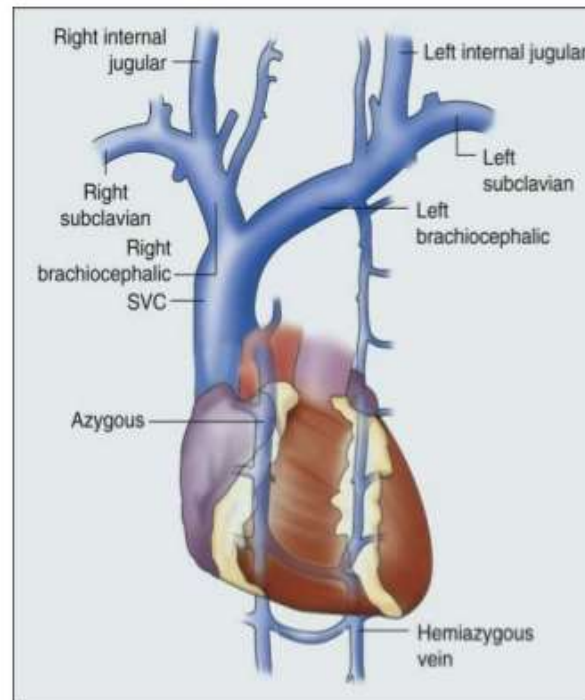
## Anatomical Position

- The **superior vena cava** is classified as a large vein, with a wide diameter of up to 2cm and a length of approximately 7cm.
- It arises from the union of the **left and right brachiocephalic veins**, posterior to the first right costal cartilage. It descends vertically through the superior mediastinum, behind the intercostal spaces and to the right of the aorta and trachea.
- At the level of the second costal cartilage, the SVC enters the **middle mediastinum** and becomes surrounded by the fibrous pericardium. It terminates by emptying into the superior aspect of the right atrium at the level of the third costal cartilage.

# Superior Vena Cava

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## Anatomy



- Thin walled.
- Low pressure vessel.
- Drainage of venous blood from upper half of body.
- 7cm in length.
- 20-22mm in diameter.



## Superior Vena Cava

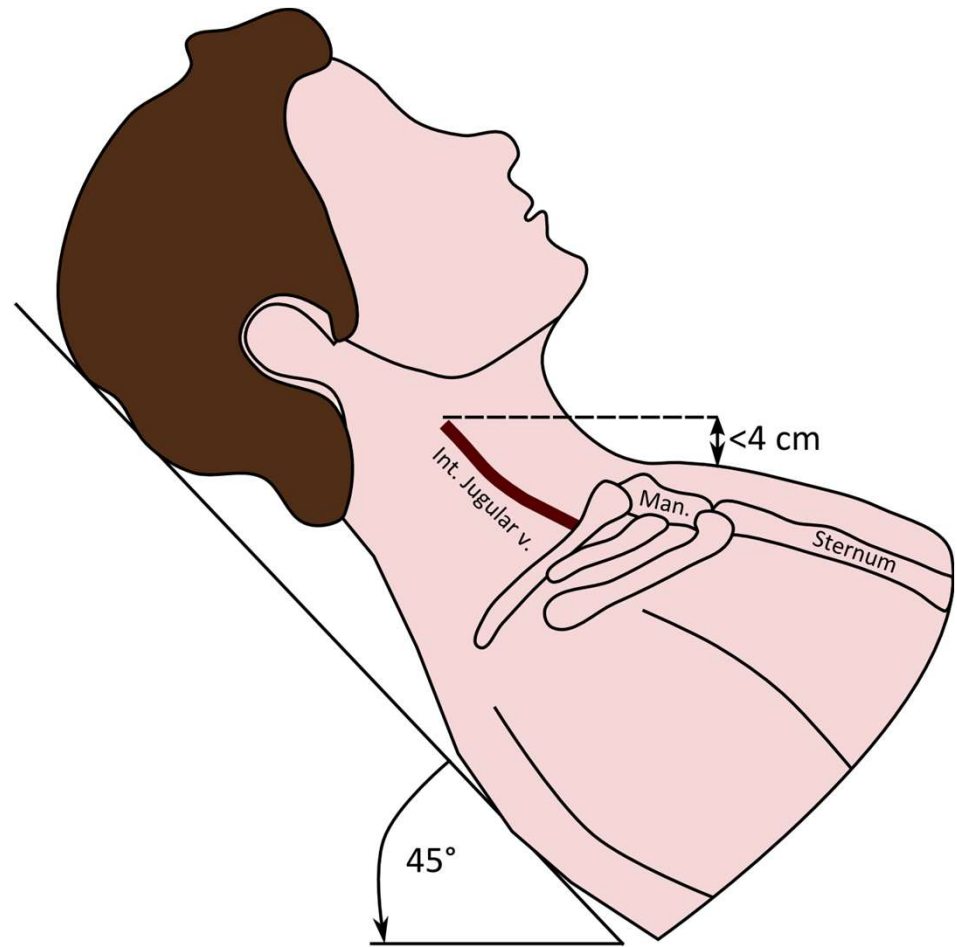
### Clinical Relevance

#### Jugular Venous Pressure

- The superior vena cava is a **valveless** structure. This allows the pressure in the right atrium to be conducted upwards into the right internal jugular vein.
- Visualisation of the right internal jugular vein is an indicator of the **jugular venous pressure** – which in turn represents the pressure in the right atrium. To examine, the patient should be at a 45° angle with their head turned slightly to the left. The JVP can be identified as a pulsation between the two heads of the sternocleidomastoid muscle.
- Causes of a raised JVP include **right-sided heart failure**, pulmonary hypertension and SVC obstruction.

# Superior Vena Cava

Jugular Venous Pressure



# Superior Vena Cava

## Tributaries

- The **superior vena cava** contains venous blood from the head, neck, both upper limbs and from structures within the thorax
- It is formed by the union of the right and left **brachiocephalic veins** – which provide venous drainage of the head, neck and upper limbs. At the level of T4, the superior vena cava receives the azygous vein, which drains the upper lumbar region and thoracic wall.

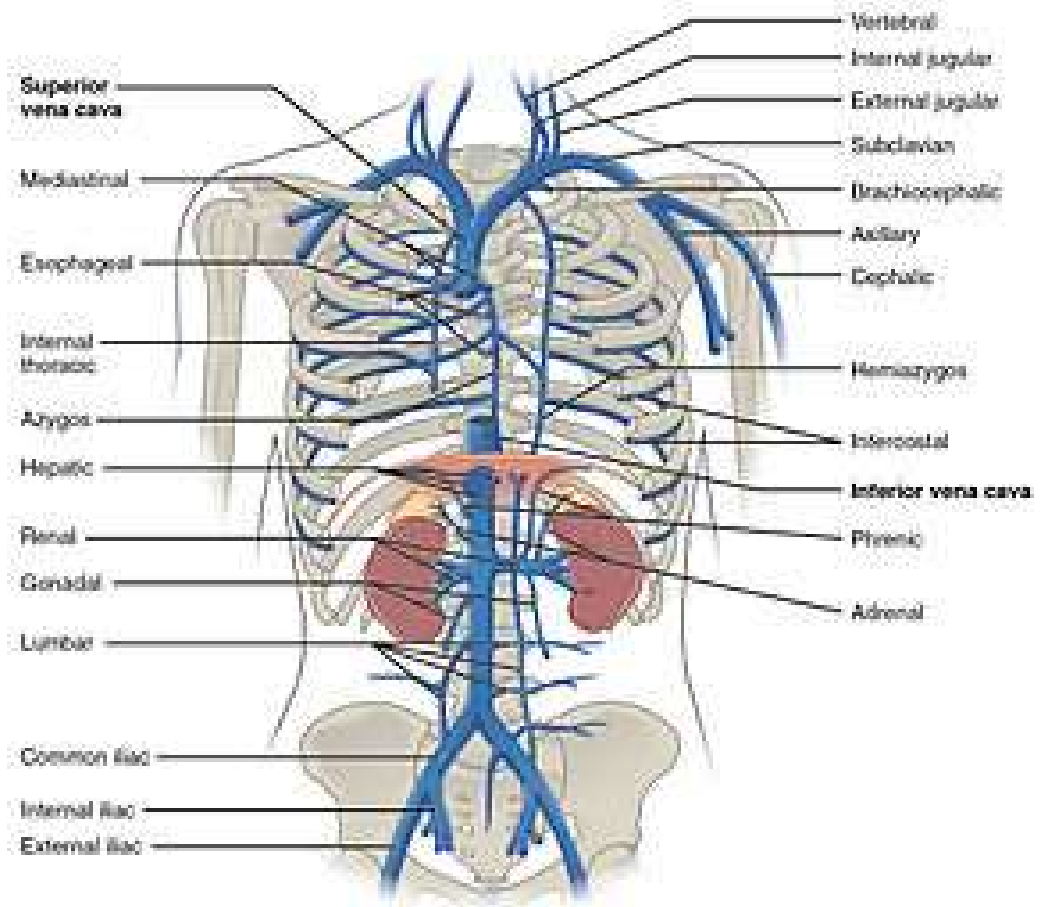
The SVC receives tributaries from several minor vein groups:

- Mediastinal veins
- Oesophageal veins
- Pericardial veins



# Superior Vena Cava

## Tributaries





## Superior Vena Cava

### Clinical Relevance: Superior Vena Cava Obstruction

- The superior vena cava is a thin-walled, low pressure vessel which makes it vulnerable to **compression**.
- Superior vena cava obstruction can occur either due to external compression or from an occlusion within the vessel lumen itself. The most common cause of SVC obstruction is **malignancy**, typically from lung cancer, lymphoma or metastatic disease.
- Vessel obstruction interrupts venous return and can lead to swelling in the neck, face and upper limbs. Clinical features include shortness of breath and distension of the veins of the face and upper limb.
- SVC obstruction can be assessed clinically by performing **Pemberton's test**. The patient is asked to raise both arms above their head – a positive test is indicated if facial oedema or cyanosis occurs after approximately 1 minute.

# Superior Vena Cava

## Clinical Relevance

