

The cardiovascular system

The cardiovascular system, consists of heart, blood vessels, and blood.

Functions of the cardiovascular System

- 1.Transport, of oxygen,CO₂ , nutrient material, hormones.
2. Protection, against foreign microbes or toxins introduced into the body. The clotting mechanism protects against blood loss when vessels are damaged.
- 3.Regulation of body temperature.

The heart

Location of the Heart

The human heart is located within the thoracic cavity, medially between the lungs in the space known as the mediastinum. Within the mediastinum, the heart is separated from the other mediastinal structures by a tough membrane known as the pericardium, or pericardial sac, and sits in its own space called the pericardial cavity. The dorsal surface of the heart lies near the bodies of the vertebrae, and its anterior surface sits deep to the sternum and costal cartilages. The great veins, the superior and inferior venae cavae, and the great arteries, the aorta and pulmonary trunk, are attached to the superior surface of the heart, called the base. The base of the heart is located at the level of the third costal cartilage, The inferior tip of the heart, the apex, lies just to the left of the sternum between the junction of the fourth and fifth ribs near their articulation with the costal cartilages. The right side of the heart is deflected anteriorly, and the left side is deflected posteriorly.

The wall of heart consist of

- 1.the inner surface is lined with endocardium.
- 2.the myocardium, consists largely of cardiac muscle tissue.
- 3.the epicardium, is the visceral layer of the serous pericardium.

Chambers and valves of the heart

The heart has four chambers. The two atria (RT and LT) and two ventricles (RT and LT). Internally, a wall called the septum separates the heart into a right side and a left side. The heart has four valves:

1. the RT atrioventricular (tricuspid) valves between the RT atrium and RT ventricles.
- 2.the LT atrioventricular valves between the LT atrium and LT ventricles.

These valves are supported by strong fibrous strings called chordae tendineae which attached topapillary muscle in the ventricular walls'.

- 3.the pulmonary semilunar valve lies between the right ventricle and the pulmonary trunk.
- 4.The aortic semilunar valve lies between the left ventricle and the aorta.

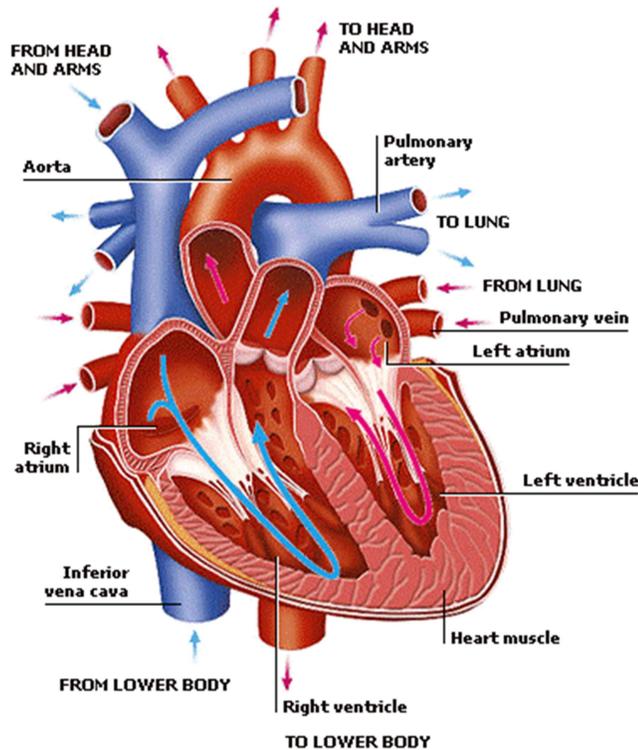
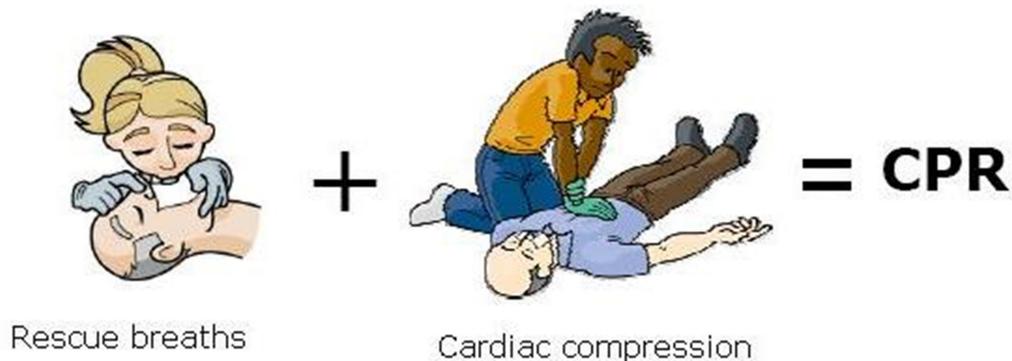


Figure: chambers of the heart.

Cardiopulmonary resuscitation (CPR)

Cardiopulmonary resuscitation is an emergency procedure that combines chest compressions often with artificial ventilation in an effort to preserve cerebral circulation and maintain brain function until further measures are taken to restore spontaneous blood circulation and breathing in a person who is in cardiac arrest.



Principal blood vessels

Blood vessels form a closed tubular network that permits blood to flow from the heart to all body tissues and then back to the heart. Blood leaving the heart passes through **arteries**, **arterioles**, and **capillaries**. Blood returning from the capillaries to **venules** and **veins** then return to the heart. The walls of arteries and veins are composed of three layers,.

- **tunica externa**, or adventitia, the outermost layer, is composed of loose connective tissue.
- **tunica media**, the middle layer, is composed of smooth muscle. The tunica media of arteries has variable amounts of elastic fibers.
- **tunica interna**, the innermost layer, composed of simple squamous epithelium (**endothelium**).

Capillaries are the narrowest of blood vessels (7–10 μm in diameter), and serve as the functional units of the circulatory system. It is across their walls that exchanges of gases (O_2 and CO_2), nutrients, and wastes between the blood and the tissues take place.

Principal arteries of the body

1. The ascending aorta, rises about 5 cm above the left ventricle. Its only branches are the coronary arteries, which arise behind two cusps of the aortic valve. They supply the wall of the heart.

2. The aortic arch, gives off three major arteries:

- **brachiocephalic trunk (innominate artery)**, it divide into right common carotid artery, which extends to the right side of the neck and head, and right subclavian artery, which carries blood to the right shoulder and upper extremity.
- **the left common carotid artery**, transports blood to the left side of the neck and head,
- **the left subclavian artery**, supplies the left shoulder and upper extremity.

3. The descending aorta passes downward through the thoracic and abdominal cavities. It is called the **thoracic aorta** above the diaphragm and the **abdominal aorta** below. It ends in the lower abdominal cavity by forking into the right and left common iliac arteries.

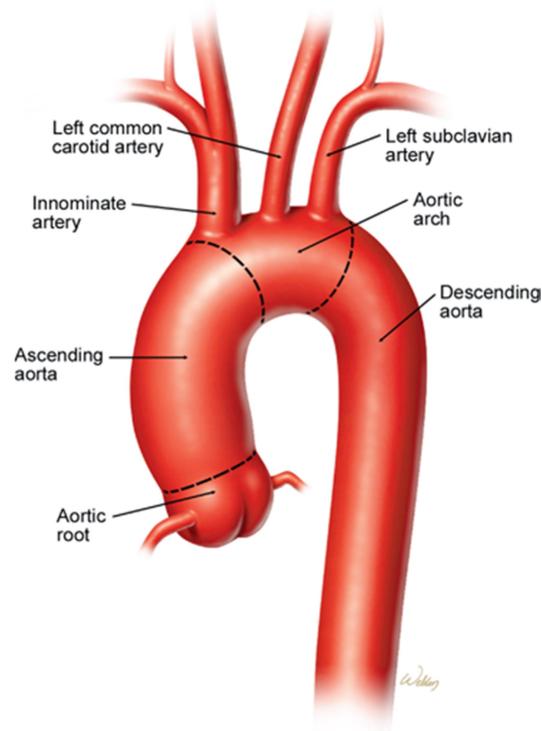


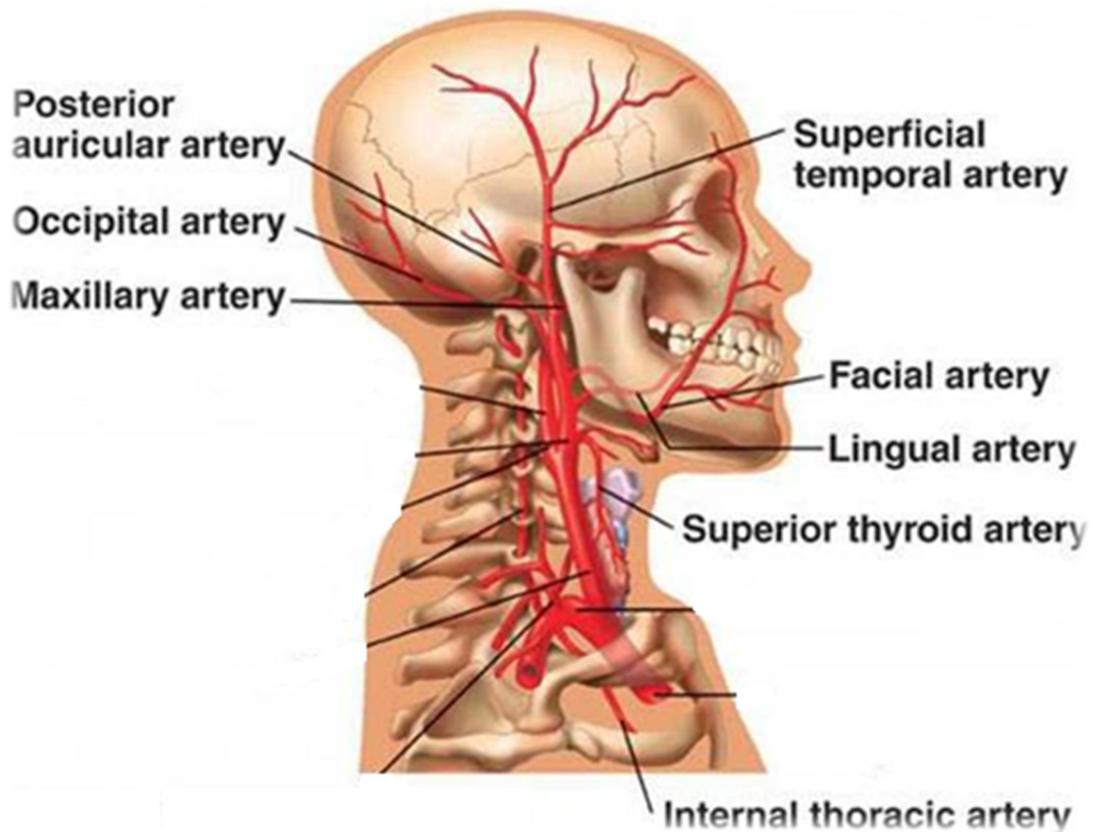
Figure: arch of the aorta and its major branches.

The common carotid arteries

The common carotid arteries course upward in the neck along the lateral sides of the trachea. Each common carotid artery branches into the **internal and external carotid** artery. At the base of the internal carotid artery is a slight dilation called the carotid sinus, which contains baroreceptors, which monitor blood pressure.

Main branches of the external carotid artery that supply the head and neck

1. superior thyroid artery: supply the thyroid gland
2. ascending pharyngeal artery.
3. Lingual artery.
4. Fascial artery.
5. occipital artery.
6. superior temporal artery.

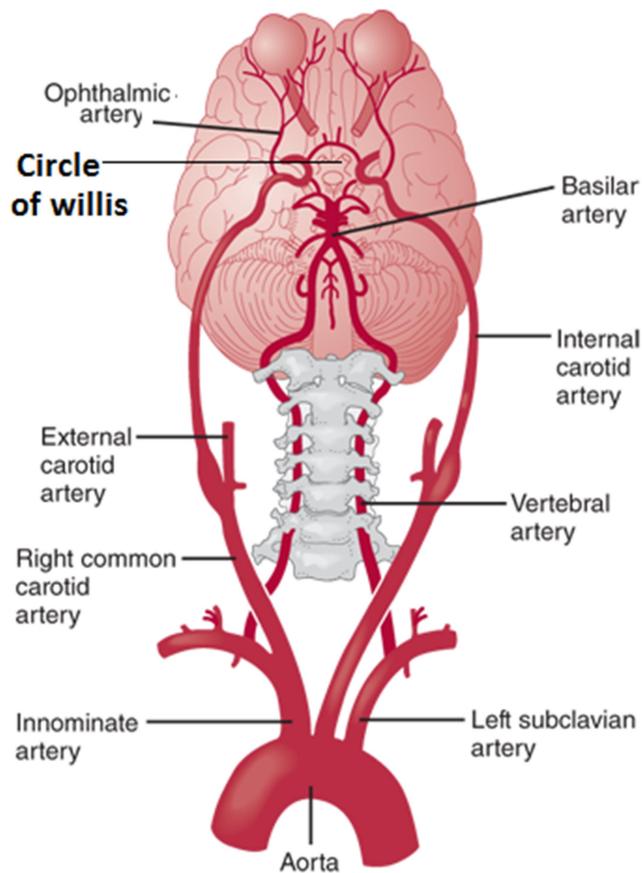


Branches of the external carotid artery

Blood Supply to the Brain

The brain is supplied with arterial blood through four vessels:

1. Two internal carotid artery, arises from the common carotid artery and ascends in the neck and then enter the skull, it give three branches; the ophthalmic artery which supplies the eye, and the anterior and middle cerebral arteries, which provide blood to the cerebrum. The anterior cerebral artery on each bind with each other by anterior communicating arteries.
2. Two vertebral arteries , which arise from the subclavian arteries and pass superiorly through the transverse foramina of the cervical vertebrae and enter the skull through the foramen magnum. Within the cranium, the two vertebral arteries unite to form the basilar artery. The basilar artery terminates by forming two posterior cerebral arteries. The posterior communicating branches of the posterior cerebral arteries .



Circle of willis

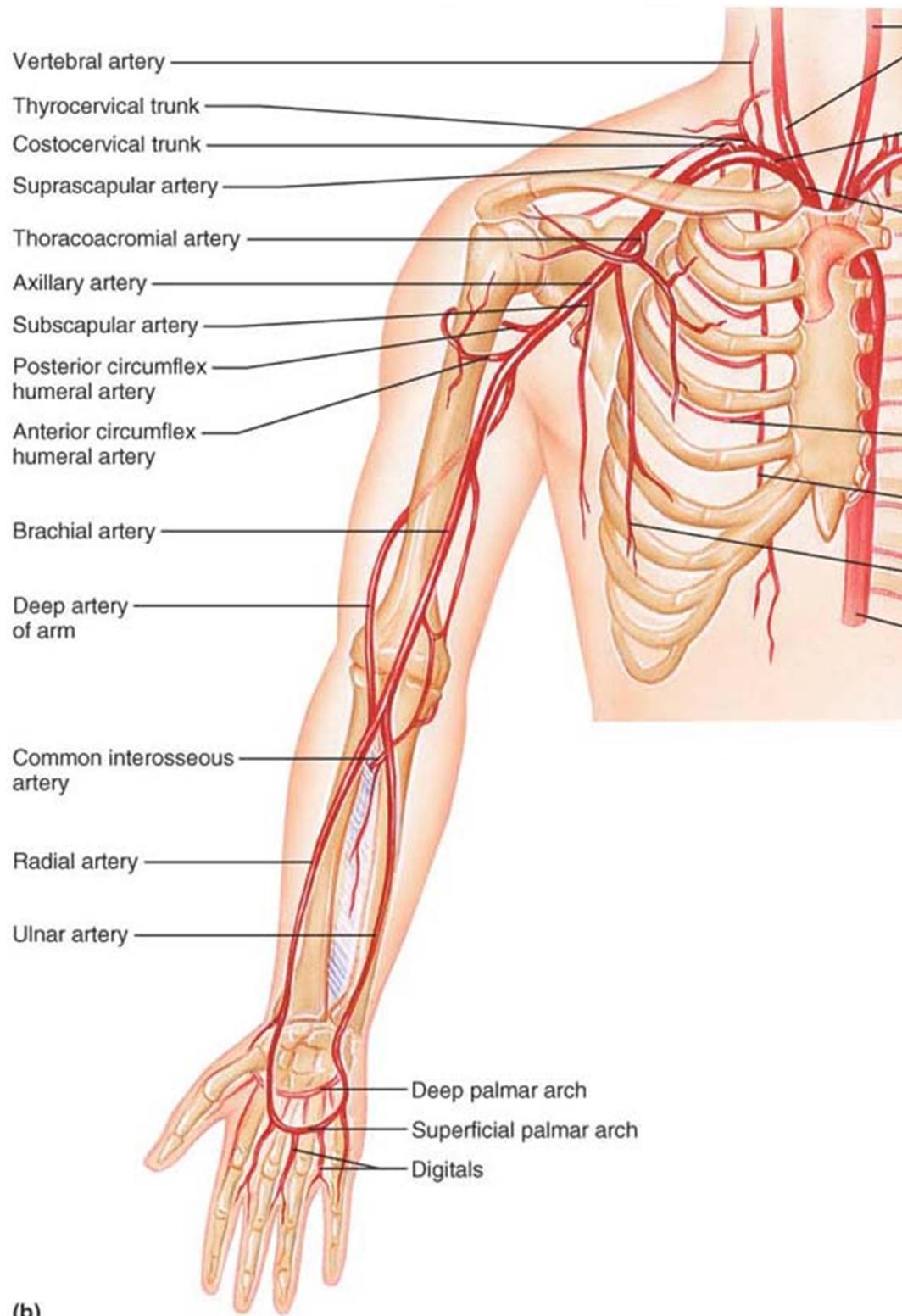
Circle of willis

The circle consist of :

1. two posterior cerebral artery.
2. two posterior communicating artery.
3. two anterior cerebral artery
4. a single anterior communicating arteries.

Arteries of the Shoulder and Upper Extremity

The right subclavian artery arises from the brachiocephalic trunk, and the left subclavian artery arises directly from the aortic arch . From each subclavian artery arises a vertebral artery that carries blood to the brain. The axillary artery is the continuation of the subclavian artery it start at the outer border of the first rib and end at the lower border of the teres major muscle, where it become the brachial artery. The brachial artery courses on the medial side of the humerus. Just proximal to the cubital fossa, the brachial artery branches into the radial and ulnar arteries, which supply blood to the forearm and a portion of the hand and digits. The radial artery is important as a site for recording the pulse near the wrist.

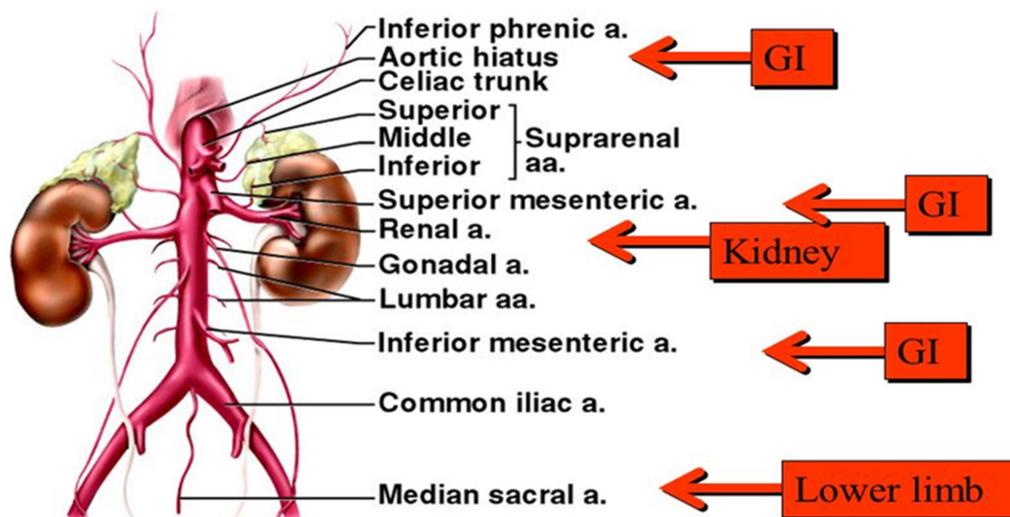


Branches of the Thoracic portion of the aorta

1. **pericardial arteries**, going to the pericardium of the heart.
2. **bronchial arteries** for systemic circulation to the lungs.
3. **esophageal arteries**, going to the esophagus
4. **posterior intercostal arteries**, serving the wall of the thorax .
5. **superior phrenic arteries**, supplying blood to the diaphragm.

Main branches of the abdominal portion of the aorta

1. **celiac trunk**, an unpaired vessel that divides immediately into three arteries: the **splenic**, going to the spleen; the **left gastric**, going to the stomach; and the **common hepatic**, going to the liver.
2. The **superior mesenteric artery** , supplies blood to the small intestine the cecum, the appendix, the ascending colon, and the proximal two-thirds of the transverse colon.
3. paired **renal arteries** that carry blood to the kidneys.
4. **testicular arteries** in the male and the **ovarian arteries** in the female are small
5. The **inferior mesenteric artery** supplies blood to the distal one-third of the transverse colon, the descending colon, the sigmoid colon, and the rectum.



Main branches of the abdominal portion of the aorta

Arteries of the pelvis and lower extremity

The abdominal portion of the aorta terminates in the posterior pelvic area as it bifurcates into the right and left common iliac arteries, which terminate by dividing into the internal and external iliac arteries:

1.The internal iliac artery has extensive branches to supply arterial blood to the gluteal muscles and the organs of the pelvic region.

2.The external iliac artery passes out of the pelvic cavity deep to the inguinal ligament and becomes the **femoral artery**. The femoral artery passes through an area called the **femoral triangle** on the upper medial portion of the thigh. At this point, it is close to the surface and its pulse can be palpated. Several vessels arise from the femoral artery to serve the thigh region. The femoral artery becomes the **popliteal artery** as it passes across the posterior aspect of the knee then divides into an anterior tibial artery and a posterior tibial artery . At the ankle, the anterior tibial artery becomes the dorsal pedal artery that serves the ankle and dorsum (superior portion) of the foot and then contributes to the formation of the dorsal arch of the foot. Clinically, palpation of the dorsal pedal artery can provide information about circulation to the foot; more important, it can provide information about the circulation in general because its pulse is taken at the most distal portion of the body. The posterior tibial artery gives off a large fibular, or peroneal, artery to serve the peroneal muscles of the leg. At the ankle, the posterior tibial bifurcates into the lateral and medial plantar arteries that supply the sole of the foot. The lateral

