Chapter 13 Cardiovascular System

Cardiovascular System:

The cardiovascular (CV) system consists of the heart, and vessels, arteries, capillaries and veins.

What are the functions of the CV system?

Structure of the Heart:

The heart is a hollow, _____-shaped, muscular pump within the _____ cavity.

The average adult heart is _____ cm long and _____ cm wide.

The heart lies in the _____ under the sternum; its apex extends to the _____ intercostal space.

Pericardium: It is made of two layers: the outer, tough connective tissue _____pericardium surrounding a more delicate double-layered sac that surrounds the heart.

The inner layer covers the heart directly and is called the _____ pericardium (or _____).

At the base of the heart, the inner layer folds back to become the _____ pericardium that lines the tough outer layer.

Between the two pericardia is a potential space called the pericardial cavity and filled with _____ _____ fluid.

Wall of the Heart:

The wall of the heart is composed of three distinct layers. The outermost layer, the _____, is made up of connective tissue and epithelium, and contains blood and lymph capillaries along with _____ arteries. It is the same as the visceral pericardium.

The middle layer, called _____consists of cardiac muscle and is the thickest layer of the heart wall.

The inner _____is smooth and is made up of connective tissue and epithelium, and is continuous with the endothelium of major vessels joining the heart.

Heart Chambers:

The heart has four internal chambers: two on top and two below. A _____ divides the chambers on each side.

Upper chambers, _____, receive blood returning to the heart and have thin walls and ear-like auricles projecting from their exterior. Below them, the thick-muscled _____ pump blood to the body and lungs.

Heart Valves: The right atrioventricular (A-V) valve, called _____, and left A-V valve, called either _____ (or the _____ valve) have cusps to which strings called _____ _____ attach.

These strings are, in turn, attached to _____ muscles in the inner heart wall that contract during ventricular contraction to prevent the backflow of blood through the A-V valves.

Where are the semilunar valves found? What is their function?

Skeleton of the heart: Rings of dense connective tissue lie surrounding the pulmonary trunk and aorta to provide attachments for the heart _____ and _____. These tough rings prevent dilating of tissue in this area.

Path of blood through heart: superior and inferior vena cava, _____, _____ valve, _____, _____ valve, _____ lungs, _____, _____, _____ valve, _____, _____, valve, _____ body

Which part is pulmonary and which is systemic?

What is the function of pulmonary circulation? Of systemic circulation?

Blood Supply to the Heart: The first branches off of the aorta, which carry freshly oxygenated blood, are the right and left _____ arteries that feed the heart muscle itself. Branches of these arteries feed many capillaries of the myocardium.

The heart muscle requires a continuous supply of freshly oxygenated blood, so smaller branches of arteries often have _____ as alternate pathways for blood, should one pathway become blocked.

_____ veins drain blood from the heart muscle and carry it to the coronary _____.

Heart Actions:

Cardiac Cycle: The cardiac cycle consists of the atria beating in unison (atrial_____), while the ventricles rest (_____), followed by the contraction of both ventricles, (ventricular _____) then the entire heart relaxes for a brief moment.

During the cardiac cycle, pressure within the heart chambers rises and falls. These pressure changes open and close _____.

When the atria fill, pressure in the atria is _____ than that of the ventricles, which forces the _____ valves open.

Pressure inside atria rises further as they contract, forcing the remaining blood into the ventricles. When ventricles contract, pressure inside them _____ sharply, causing _____ valves to close and the _____ and _____ valves to open.

As the ventricles contract, _____ muscles contract, pulling on _____ and preventing the backflow of blood through the A-V valves.

Heart sounds: Heart sounds can be described as a "lubb-dupp" sound. The first sound (lubb) occurs as _____ contract and _____valves are closing.

The second sound (dupp) occurs as _____ relax and aortic and _____ valves are closing.

Cardiac Conduction System: A mass of merging fibers that act as a unit is called a functional _____; One exists in the atria and one in the ventricles.

Specialized cardiac muscle tissue conducts impulses throughout the myocardium and comprises the cardiac conduction system. A self-exciting mass of specialized cardiac muscle called the _____ node (_____ node or pacemaker), located on the posterior right atrium, generates the impulses for the heartbeat.

Impulses spread next to the atrial _____, it contracts, and impulses travel to the junctional fibers leading to the _____ node (_____node) located in the septum. Junctional fibers are small, allowing the atria to contract before the impulse spreads rapidly over the ventricles.

Branches of the _____bundle give rise to _____ fibers leading to papillary muscles these fibers stimulate contraction of the papillary muscles at the same time the ventricles contract.

Electrocardiogram (ECG): The first wave, the _____ wave, corresponds to the _____ of the atria.

The _____ complex corresponds to the _____ of ventricles and hides the _____ of atria.

The _____ waves end the ECG pattern and correspond to ventricular _____.

Regulation of the Cardiac Cycle: The amount of blood pumped at any one time must adjust to the current needs of the body (more is needed during strenuous exercise). The S-A node is innervated by branches of the _____ and _____ divisions, so the CNS controls heart rate. Impulses from the former speed up and impulses from the latter slow down heart rate.

The _____ control center of the _____ _____ maintains a balance between the two autonomic divisions of the nervous system in response to messages from _____ which detect changes in blood pressure.

Impulses from _____ or _____ may also influence heart rate, as do body temperature and the concentrations of certain _____.

Blood Vessels:

The blood vessels (arteries, arterioles, capillaries, venules, and veins) form a closed tube that carries blood away from the heart, to the cells, and back again.

Arteries:

Arteries are strong, elastic vessels adapted for carrying high-pressure blood. Arteries become smaller as they divide and become _____.

The wall of an artery consists of an inner endothelium layer, called the tunica _____. The middle layer, called the tunica _____ is made up of smooth muscle. The tunica _____ is the outermost layer of connective tissue.

Arteries are capable of _____ as directed by the sympathetic impulses; when impulses are inhibited, the diameter of the vessel increases (_____).

Capillaries:

Capillaries are the smallest vessels, consisting only of a layer of _____ through which substances are exchanged with tissue cells.

Areas with a great deal of metabolic activity (leg muscles, for example) have higher densities of capillaries.

_____ sphincters can regulate the amount of blood entering a capillary bed and are controlled by _____ _____ concentration in the area. If blood is needed elsewhere in the body, the capillary beds in less important areas are shut down.

Capillary Exchanges: Blood entering capillaries contains high concentrations of _____ and _____ that diffuse out of the capillary wall and into the _____ _____.

Why do plasma proteins remain in the blood? _____ pressure drives the passage of fluids and very small molecules out of the capillary at this point.

At the venule end, _____, due to the proteins in the blood, causes much of the tissue fluid to return to the bloodstream. _____ vessels collect excess tissue fluid and return it to circulation.

Veins:

Small vessels called _____ lead from capillaries and merge to form larger _____ that return blood to the heart.

Veins have the same three layers as arteries have and have a flap-like _____ inside to prevent backflow of blood. How do veins differ from arteries?

Blood Pressure:

Blood pressure is the force of blood against the inner walls of blood vessels anywhere in the cardiovascular system, although the term "blood pressure" usually refers to _____ pressure.

Arterial blood pressure rises and falls following a pattern established by the cardiac cycle. During ventricular contraction, arterial pressure is at its _____ (_____ pressure). When ventricles are relaxing, arterial pressure is at its _____ (_____ pressure).

The surge of blood that occurs with ventricular contraction can be felt at certain points in the body as a _____.

Factors that Effect Blood Pressure:

What are the four factors that affect blood pressure?

Control of Blood Pressure: The body maintains normal blood pressure by adjusting cardiac output and peripheral resistance. Cardiac output depends on _____ volume and _____ rate, and a number of factors can affect these actions. Describe the factors that affect these actions.

The _____center of the _____ _____ in the brain stem can adjust the sympathetic impulses to _____ _____ in arteriole walls, adjusting blood pressure.

Mechanisms of Blood Return: Blood pressure at the venule end of a capillary is almost 0.

So other factors help return the blood to the heart.

Contractions of _____muscle squeeze blood back up veins one valve and a time. Differences in _____ and _____ pressures draw blood back up the veins.

Study analogy: Think of a juice box. The straw sucks the juice out of the container because of a difference in pressure between the drinker's mouth and the box. But if you squeeze the box, the juice also moves up into the straw. Both are similar to what happens in the veins in our bodies.

Arterial System:

The _____ is the body's largest artery. Be able to recognize and locate the following arteries:

- Principal Branches
- The branches of the ascending aorta are the right and left coronary arteries that lead to heart muscle.
- Principal branches of the aortic arch include the brachiocephalic, left common carotid, and left subclavian arteries.
- The descending aorta (thoracic aorta) gives rise to many small arteries to the thoracic wall and thoracic viscera.
- The abdominal aorta gives off the following branches: celiac, superior mesenteric, suprarenal, renal, gonadal, inferior mesenteric, and common iliac arteries.

Arteries to the Head, Neck, and Brain:

- Arteries to the head, neck, and brain include branches of the subclavian and common carotid arteries.
- The vertebral arteries supply the vertebrae and their associated ligaments and muscles.
- In the cranial cavity, the vertebral arteries unite to form a basilar artery that ends as two posterior cerebral arteries.
- The posterior cerebral arteries help form the circle of Willis that provides alternate pathways through which blood can reach the brain.
- The right and left common carotid arteries diverge into the external carotid and internal carotid arteries.
- Near the base of the internal carotid arteries are the carotid sinuses that contain baroreceptors to monitor blood pressure.

Arteries to the Shoulder and Upper Limb

- The subclavian artery continues into the arm where it becomes the axillary artery.
- In the shoulder region, the axial artery becomes the brachial artery that, in turn, gives rise to the ulnar and radial arteries

Arteries to the Thoracic and Abdominal Walls

- Branches of the thoracic aorta and subclavian artery supply the thoracic wall with blood.
- Branches of the abdominal aorta, as well as other arteries, supply the abdominal wall with blood.

Arteries to the Pelvis and Lower Limb

- At the pelvic brim, the abdominal aorta divides to form the common iliac arteries that supply the pelvic organs, gluteal area, and lower limbs.
- The common iliac arteries divide into internal and external iliac arteries.
- Internal iliac arteries supply blood to pelvic muscles and visceral structures.
- External iliac arteries lead into the legs, where they become femoral, popliteal, anterior tibial and posterior tibial arteries.

Venous System: Veins return blood to the heart after the exchange of substances has occurred in the tissues.

Larger veins parallel the courses of arteries and are named accordingly; smaller veins take irregular pathways and are unnamed.

Veins from the head and upper torso drain into the _____.

Veins from the lower body drain into the _____. Both go to the _____ atrium.

Be able to recognize and locate these veins:

Veins from the Head, Neck, and Brain

- The jugular veins drain the head and unite with the subclavian veins to form the brachiocephalic veins.

Veins from the Upper Limb and Shoulder

- The upper limb is drained by superficial and deep veins.
- The basilic and cephalic veins are major superficial veins.
- The major deep veins include the radial, ulnar, brachial, and axillary veins.

Veins from the Abdominal and Thoracic Walls

- Tributaries of the brachiocephalic and azygos veins drain the abdominal and thoracic walls.

Veins from the Abdominal Viscera

- Blood draining from the intestines enters the hepatic portal system and flows to the liver first rather than into general circulation.
- Hepatic veins drain the liver, gastric veins drain the stomach, superior mesenteric veins lead from the small intestine and colon, the splenic vein leaves the spleen and pancreas, and the inferior mesenteric vein carries blood from the lower intestinal area.

Veins from the Lower Limb and Pelvis

- Deep and superficial veins drain the leg and pelvis.
- The deep veins include the anterior and posterior tibial veins which unite into the popliteal vein and femoral vein; superficial veins include the small and great saphenous veins.
- These veins all merge to empty into the common iliac veins.