

NAME: BOROKINNI OLUWATOFUNMI DIVINE

MATRIC NUMBER: 18/MHS01/112

DEPARTMENT: MEDICINE AND SURGERY (MBBS)

COLLEGE: MEDICINE AND HEALTH SCIENCES (MHS)

COURSE: CARDIOVASCULAR PHYSIOLOGY

LEVEL: 200L

SOLUTION TO ASSIGNMENT

1. Discuss the long-term regulation of mean arterial blood pressure

Solution: renin-angiotensin-aldosterone system (RAAS) is a long term regulator of blood pressure. Renin is a peptide hormone released by the granular cells of the juxtaglomerular apparatus in the kidney. It is released in response to: sympathetic stimulation, reduced sodium-chloride delivery to the distal convoluted tubule and decreased blood flow to the kidney. Renin improves the conversion of angiotensinogen to angiotensin ii using angiotensin-converting enzyme (ACE). Angiotensin ii is a potent vasoconstrictor. It acts directly on the kidney to increase sodium reabsorption in the proximal convoluted tubule. Sodium is reabsorbed via the sodium-hydrogen exchanger. Angiotensin ii also promotes release of aldosterone. Aldosterone promotes salt and water retention by acting at the distal convoluted tubule to increase expression of epithelial sodium channels. Also, aldosterone increases the activity of the basolateral sodium-potassium ATP-ase, thus increasing the electrochemical gradient for movement of sodium ions. More sodium collects in the kidney tissue and water then follows by osmosis. This results in decreased water excretion and therefore increased blood volume and thus blood pressure.

The release of Anti Diuretic Hormone (ADH) also regulates the mean arterial blood pressure on a long term in response to thirst or an increased plasma osmolarity. ADH acts to increase the permability of the collecting duct to water by inserting aquaporin channels into the apical membrane.

2. Write short notes on the following:

- a. **Pulmonary circulation:** pulmonary circulation is the portion of the circulatory system that carries deoxygenated blood away from the right ventricle, to the lungs and returns oxygenated blood to the left atrium and left ventricle of the heart. Pulmonary circulation facilitates the process of external respiration because the pulmonary artery carries deoxygenated blood from the right ventricle to the lungs via the capillary beds and arterioles; when it gets to the lungs, CO₂ is exchanged for O₂ and CO₂ is exhaled. There are two pulmonary arteries (right and left) known as pulmonary trunk. The pulmonary artery is the only artery that carries deoxygenated blood and the pulmonary vein is the only vein that carries oxygenated blood.
- b. **Circle of willis:** circle of willis is a junction of several important arteries at the bottom part of the brain. It helps blood flow from both the front and back sections of the brain. It may play a passive role in protecting a person from some health issues such as stoke. The structure of the circle of willis includes: left and right internal carotid arteries, left and right anterior cerebral arteries, left and right posterior communicating arteries, basilar artery and anterior communicating artery. The circle of willis allows for proper blood flow from the arteries to both the front and back hemispheres of the brain and serves as a sort of safety mechanism when it comes to blood flow

- c. **Splanchnic circulation:** splanchnic circulation is blood flow to the abdominal gastrointestinal organs including the stomach, liver, spleen, pancreas, small intestine and large intestine. It comprises three major branches of the abdominal aorta; the coeliac artery; superior mesenteric artery (SMA) and inferior mesenteric artery (IMA). The hepatic portal circulation delivers the majority of the blood flow to the liver. Under physiological conditions, blood flow in the splanchnic circulation is controlled via intrinsic and extrinsic mechanisms. Disorders of the splanchnic circulation may contribute to the multi-organ dysfunction syndrome and vice versa. A number of techniques used in anaesthesia and critical care influence the distribution of blood flow in the splanchnic circulation
- d. **Coronary circulation:** coronary circulation is the circulation of blood in the blood vessels that supply the heart muscle. Coronary arteries supply oxygenated blood to the heart muscle, and cardiac veins drain away the blood once it has been deoxygenated.
- e. **Cutaneous circulation:** cutaneous circulation is the circulation and blood supply of the skin. The skin is not a very metabolically active tissue and has relatively small energy requirements, so its blood supply is different to that of other tissues. Some of the circulating blood volume in the skin will flow through arteriovenous anastomoses (AVAs) instead of capillaries. AVAs serve a role in temperature regulation

3. Discuss the cardiovascular adjustment that occurs during exercise

Solution: a. Reduction of parasympathetic nervous system activity to the heart causes increase in heart rate.

- b. Increase in sympathetic nervous system activity will directly cause an increase in heart rate. It is a function of the exercise intensity.
- c. Increase of circulating epinephrine or adrenaline in the blood stimulates an increase in heart rate

This cardiovascular adjustment during exercise causes:

- i. **increased cardiac output:** increased pumping capacity of heart enhancing delivery of oxygen and fuel to working muscles.
- ii. **Increased muscle blood flow:** blood vessels in muscle dilate increasing local blood flow.
- iii. **Decreased blood flow to kidneys, liver and gut:** redirects or shunts blood flow to working muscles. The following occurs during exercise: