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LEVEL: 200L

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COURSE: PHY 201

ASSIGNMENT:

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

The regulation of blood pressure can be carried out by antidiuretic hormone (ADH) and renin-angiotensin-aldosterone system (RAAS).

Anti-Diuretic Hormone (ADH)

Here, blood pressure is regulated by the release of Anti Diuretic Hormone (ADH) from the OVLT of the hypothalamus in response to thirst or an increased plasma osmolarity.

ADH acts to increase the permeability of the collecting duct to water by inserting aquaporin channels (AQP2) into the apical membrane.

It also stimulates sodium reabsorption from the thick ascending limb of the loop of Henle. This increases water reabsorption thus increasing plasma volume and decreasing osmolarity.

Renin-Angiotensin-Aldosterone System (RAAS)

Renin is a peptide hormone released by the granular cells of the juxtaglomerular apparatus in the kidney. It is released in response to:

1. Sympathetic stimulation
2. Reduced sodium-chloride delivery to the distal convoluted tubule
3. Decreased blood flow to the kidney

Renin facilitates the conversion of angiotensinogen to angiotensin I which is then converted 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.

ACE also breaks down a substance called bradykinin which is a potent vasodilator. Therefore, the breakdown of bradykinin potentiates the overall constricting effect.

Aldosterone promotes salt and water retention by acting at the distal convoluted tubule to increase expression of epithelial sodium channels. Furthermore, 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.

1. Write short notes on the following
2. Pulmonary circulation

In pulmonary circulation, the pulmonary artery supplies deoxygenated blood pumped from right ventricle to alveoli of lungs (pulmonary circulation). After leaving the right ventricle, this artery divides into right and left branches. Each branch enters the corresponding lung along with primary bronchus. After entering the lung, branch of pulmonary artery divides into small vessels and finally forms the capillary plexus that is in intimate relationship to alveoli capillary. Oxygenated blood from the alveoli is carried to left by one pulmonary vein from each side.

1. Circle of wills

It is a circulatory anastomosisthat supplies blood to the brain and surrounding structures. The circle of willis is a part of the cerebral circulation. Cerebral circulation refers to the flow of blood through the vessels of the brain. Brain tissues need adequate blood supply continuously. Stoppage of blood flow to the brain for five seconds leads to unconsciousness and for five minutes leads to irreparable brain damage to the brain cells. Brain receives blood from the basilar artery and internal artery carotid artery. Branches of these arteries form the circle of willis.

1. Splanchic circulation

It describes the bood flow to the abdominal gastrointestinal organs including the stomach, liver, spleen, pancreas, small intestine, and large intestine. The distinct characteristic of the splanchic circulation is that the blood from mesenteric bed and spleen forms a major amount of blood flowing to liver. Blood flows to liver from GI tract and spleen through portal system.

It constitutes three portions:

1. Mesenteric circulation supplying blood to GI tract
2. Splenic circulation supplying blood to spleen
3. Hepatic circulation supplying blood to liver
4. Coronary circulation

This is the circulation of blood through blood vessels of the heart muscle (myocardium). It is responsible for functional blood supply to heart muscle itself. Blood flowing through the chambers of heart does not nourish the myocardium. When functioning normally, blood in coronary blood vessels supply adequate oxygen to myocardium. Like systematic circulation and pulmonary circulation is also made up of arteries, arterioles, capillaries venules and veins.

1. Cutaneous circulation

It is regulated mainly by body temperature increases. Hypothalamus plays an important role in regulating cutaneous blood flow. When body temperature increases, the hypothalamusis activated. Hypothalamus in turn causes cutaneous vasodilation by acting through medullary vasomotor center. Now, blood flow causes the loss of heat from the body through sweat. When body temperature is low, vasoconstriction occurs in the skin. Therefore, the blood flow to skin decreases and prevents the heat loss from skin.

1. Discuss the cardiovascular adjustments that occurs during exercise

During exercise, cardiac output increases to provide the floe needed to serve the contracting skeletal muscle. Yet by resetting the operating point for the arterial baroreceptors, vasodilation is regulated to make blood pressure stable or to increase during exercise. Such a balance between cardiac output and peripheral resistance would be considered to be governed by an interplay between the autonomic influence of the heart vasodilatory substance released from the working muscles and sympathetic mediated vasoconsrriction including active skeletal muscles.