Oriola Eniola Precious 18/mhs01/316 mbbs physiology assignment

Long term regulation of mean arterial blood pressure

There are several mechanisms to regulate blood pressure in the long term

1. 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

\*sympathetic stimulation

\*reduced sodium-chloride delivery to the distal convoluted tubule

\*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.

2. Anti-diuretic hormone (ADH)

The second mechanism by which blood pressure is regulated is 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 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.

3. Atrial natriuretic peptide (ANP) is synthesized and stored in cardiac myocytes. It is released when the atria are stretched, indicating of high blood pressure. ANP acts to promote sodium excretion. It dilates the afferent arteriole of the glomerulus, increasing blood flow (GFR). Moreover, ANP inhibits sodium reabsorption along the nephron. Conversely, ANP secretion is low when blood pressure is low.

4. Prostaglandins act as local vasodilators to increase GFR and reduce sodium reabsorption. They also act to prevent excessive vasoconstriction triggered by the sympathetic nervous and renin-angiotensin-aldosterone systems.

2a. pulmonary circulation: is the portion of the circulatory system which carries deoxygenated blood away from the right ventricle to the lungs and returns oxygenated blood to the left atrium and ventricle of the heart. The vessels of the pulmonary circulation are pulmonary arteries and pulmonary veins.

b. Circle of Willis: is the joining area of several arteries at the inferior side of the brain and surrounding structures

c. splanchnic circulation: consists of the blood supply to the gastric small intestine colonic pancreatic hepatic splenic circulations they are arranged in parallel and fed by the celiac artery and the superior and inferior mesenteric arteries, the splanchnic venus capacitance reservoir contains about one-third of the body’s total blood volume, it requires about 25 percent of cardiac output

d. coronary circulation : is the circulation of blood in the blood vessels that supply the heart muscle (myocardium). They supply oxygenated blood to the heart muscles and cardiac veins drains away the blood once it has been deoxygenated. Interruption of coronary circulation quickly causes heart attack due to oxygen starvation.

e. cutaneous circulation: is the circulation and blood supply of the skin. The blood supplied to the skin helps to maintain the body temperature. The circulation to the skin is about 4% of the total cardiac output.

3. cardiovascular adjustment that occurs during exercise

During execise there is;

an increase in cardiac output

increase in cardiac rate

increased contractility

increased blood flow to the heart n body