NAME: BAPPA RUQAYYA BALA

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Assignment 1

1. Discuss the long-term regulation of mean arterial blood pressure? When the nervous mechanism becomes inefficient, the kidneys take up action by engaging in a long-term regulation. This happens in two ways.
   - By regulation of ECF volume
   - Through renin-angiotensin mechanism

-By regulation of ECF volume: When the blood pressure increases, kidneys excrete large amounts of water and salt, particularly sodium, by means of pressure diuresis and pressure natiuresis. Pressure diuresis is the excretion of large quantity of water in urine because of increased blood pressure. Even a slight increase in blood pressure doubles the water excretion. Pressure natiuresis is the excretion of large quantity of sodium in urine.

Because of diuresis and natiuresis, there is a decrease in ECF volume and blood volume, which in turn brings the arterial blood pressure back to normal level. When blood pressure decreases, the re-absorption of water from renal tubules is

increased. This in turn, increases ECF volume, blood volume and cardiac output, resulting in restoration of blood pressure.

-Through renin-angiotensin mechanism

Actions of angiotensin II: when blood pressure and ECF volume decrease, renin secretion from kidneys is increased. It converts angiotensinogen into angiotensin I. this is converted into angiotensin II by ACE (angiotensin-converting-enzyme).

Angiotensin II acts in two ways to restore the blood pressure:

i. It causes constriction of arterioles in the body so that the peripheral resistance is increased and blood pressure rises. In addition, angiotensin II causes constriction of afferent arterioles in kidneys, so that glomerular filtration reduces. This results in retention of water and salts, increases ECF volume to normal level. This in turn

increases the blood pressure to normal level.

ii. Simultaneously, angiotensin II stimulates the adrenal cortex to secrete aldosterone. This hormone increases reabsorption of sodium from renal tubules. Sodium re absorption is followed by water reabsorption resulting in increased ECF volume and blood volume. It increases the blood pressure to normal level

Action of angiotensin III and angiotensin IV

Like angiotensin II, the angiotensins III and IV also increase the blood pressure and stimulate adrenal cortex to secrete aldosterone.

2. Write short notes on the following:

a. **Pulmonary circulation**: it also known as lesser circulation. Its primary purpose is oxygenating deoxygenated blood for the benefit of body tissues. Blood is pumped from right ventricles

to lungs through the pulmonary artery. Exchange of gases occurs between blood and alveoli of the lungs at the pulmonary capillaries. Oxygenated blood returns to the left atrium through the pulmonary veins. Thus, left side of the heart contains oxygenated or arterial blood and the right side of the heart contains deoxygenated or venous blood.

b. Circle of Willis: this is formed from the branches of basilar artery and internal carotid artery as they move up to supply the brain.

c. Splanchnic circulation: splanchnic or visceral circulation constitutes three portions; the mesenteric circulation supplying blood to GI tract, splenic circulation supplying blood to spleen and hepatic circulation supplying blood to liver. Unique feature of splanchnic 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.

d. Coronary circulation: it 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.

e. Cutaneous circulation: cutaneous blood flow supplies nutrition to skin and regulates body temperature by heat loss. Cutaneous blood flow is regulated mainly by body temperature. Hypothalamus plays an important role in regulating cutaneous blood flow. When body temperature increases, the hypothalamus in turn causes cutaneous vasodilatation by acting through medullary vasomotor centre. Now, blood flow increases in skin. Increase in cutaneous blood flow causes the loss of heat from the body through sweat. When the body temperature is low,

vasoconstriction occurs in the skin. Therefore, the blood flow to the skin decreases and prevents the heat loss from the skin.

2. Discuss the cardiovascular adjustment that occurs during exercise?
   - Sympathetic neural pathways is triggered: this causes vasodilation in muscles in order to increase blood flow to muscles during exercise.
   - Increased heart rate: impulses from the cerebral cortex to medullary centres reduces vagal tone.
   - increased cardiac output: increase in cardiac output is directly proportional to the increase in amount of oxygen consumed during exercise
   - Increased impulse at SA node: rise in body temperature, which acts on cardiac centres via hypothalamus, increased temperature also stimulates SA node directly.
   - Increased stroke volume: it occurs due to increase in force of contraction.