NAME: OKENIYI OLUDAMILOLA LATEEFAT

MATRIC NUMBER: 18/MHS01/265

PHYSIOLOGY ASSIGNMENT

ANSWERS

1. LONG TERM REGULATION OF ARTERIAL BLOOD PRESSURE
   Kidney is responsible for the long-term regulation of arterial blood pressure. When blood pressure is altered for a long period, the nervous mechanism adapts to the altered pressure and looses the sensitivity for the changes and is unable to regulate the pressure any more. In such conditions, the renal mechanism operates efficiently to regulate blood pressure. Therefore, it is called long-term regulation.
   Kidneys regulates blood pressure by;
   I. Regulating ECF volume by means of pressure diuresis
   II. Renin-angiotensin mechanism

By Regulation Extracellular Fluid Volume

When the blood pressure increases, kidneys large amounts of water and salt, particularly sodium, by means of pressure diuresis (excretion of large quantities of water in urine because of increased blood pressure) and pressure natriuresis (excretion of large volume of sodium urine.

Diuresis and natriuresis result in decrease in ECF volume and blood volume, which in turn brings arterial blood pressure back to normal level.

When blood pressure decreases, the reabsorption of water from renal tubules is increased. This in turn, increases ECF volume, blood volume and cardiac output resulting in restoration of blood pressure.

Renin-Angiotensin mechanism

When blood pressure and ECF volume decrease, renin secretion from kidney is increased. It converts angiotensinogen into angiotensin I. thus is converted into angiotensin II by angiotensin-converting enzyme (ACE).

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. It also 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.

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

Angiotensin III and IV also increase the blood pressure and stimulate adrenal cortex to secrete aldosterone.

2.

a) **Pulmonary Circulation**
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. The pulmonary blood vessels include pulmonary artery, bronchial artery and pulmonary vein.
Pulmonary artery supplies deoxygenated blood pumped from right ventricle to alveoli of lungs. Oxygenated blood from the alveoli is carried to left atrium by one pulmonary vein from each side.
Bronchial artery supplies arterial blood to bronchi, connective tissue and other structures of lung stroma, visceral pleura and pulmonary lymph nodes. Venous blood from these structures is drained by two bronchial veins from each side. Bronchial veins from right side drain into azygos vein and the left bronchial vein drain into superior hemiazygos veins. However, the blood from distal portion of bronchial circulation is drained directly into the tributaries of pulmonary veins.

b) **Circle of Willis**
It is also called loop of Willis, cerebral arterial circle and Willis polygon. It is a circulatory anastomosis that supplies blood to the brain and surrounding structures. It is named after Thomas Willis.
The circle of Willis is composed of the following arteries; Anterior cerebral artery (left and right), Anterior communicating artery, internal carotid artery (left and right), posterior cerebral artery (left and right) and posterior communicating artery (left and right).
The left and right internal carotid arteries arise from the left and right common carotid arteries.
The posterior communicating artery is given off as a branch of the internal carotid artery just before it divides into its terminal branches. The anterior and middle cerebral arteries. The anterior cerebral artery forms the anterolateral portion of the circle of Willis, while the middle cerebral artery does not contribute to the circle.
The right and left posterior cerebral arteries arise from the basilar artery.
The anterior communicating artery connects the two anterior cerebral arteries and could be said to arise from either the left or right side.

c) **Splanchnic Circulation**

Splanchnic/Mesenteric/Visceral circulation consists of the blood supply to all the abdominal viscera (the gastrointestinal tract, liver, spleen, and pancreas).
It constitutes three portions;

I. Mesenteric circulation supplying blood to the gastrointestinal tract. Mesenteric blood flow is regulated by local auto regulation through mesenteric bed, activity of gastrointestinal tract, nervous factor and chemical factors.
II. Splenic circulation supplying blood to spleen. The spleen is the main reservoir for blood. Blood flow to spleen is regulated by sympathetic nerve fibers.
III. Hepatic circulation supplying blood to liver. The liver receives blood from hepatic artery and portal vein. Blood flow to liver is regulated by systemic blood pressure, splenic contraction, movements of intestine, chemical factors and nervous factors.

d) **Coronary Circulation**

Coronary circulation is the circulation of blood in the blood vessels that supply the myocardium.
Heart muscle is supplied by two coronary arteries, namely right and left coronary arteries, which are the first branches of aorta.
Arteries encircle the heart in the manner of a crown, hence the name coronary arteries (Latin word, corona meaning crown).
Coronary arteries supply oxygenated blood to the heart muscle and cardiac veins drain away the blood once it has been deoxygenated.
This circulation is very important because the rest of the body, most especially the brain needs a steady supply of oxygenated blood that is free of any interruptions. The heart is required to function continuously.

e) Cutaneous Circulation

This is the circulation and blood supply to 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 arteriovenous anastomoses (AVA's) instead of capillaries. AVA's serve a role in temperature regulation.
Cutaneous blood flow is regulated mainly by body temperature.
Hypothalamus plays an important role in regulating cutaneous blood flow.

3. **Cardiovascular Adjustment That occur During Exercise**

During exercise several adjustments occur on the cardiovascular system. They include;

i. Mild hypoxia which stimulates juxtaglomerular apparatus to secrete erythropoietin. It stimulates the bone marrow and cause release of red blood cells. Increased carbon dioxide content in blood, decreases the PH of blood.
ii. On blood volume; more heat is produced during exercise and the thermoregulatory system is activated. These in turn causes secretion of large

amount of sweat, which leads to fluid loss, reduced blood volume, hemoconcentration and dehydration.

iii. Heart rate increases during exercise. This occurs mainly because of vagal withdrawal. Sympathetic tone also plays some role. Other factors responsible for increased heart rate during exercise are; impulse from proprioceptors, increased carbon dioxide tension, rise in body temperature and circulating catecholamines, which are secreted in large quantities during exercise.
In moderate exercise, the heart rate increases to 180 beats/minute. In severe muscular exercise, it reaches 240 to 260 beats/minute.

iv. Cardiac output increases up to 20L/minute in moderate exercise and up to 35L/minute during severe exercise in cardiac output is directly proportional to the increase in the amount of oxygen consumed during exercise. Increase in cardiac output occurs because of increase in heart rate and stroke volume. Heart rate increases because of vagal withdrawal. Stroke volume increases due to increased force of contraction.

v. Venous return increases during exercise because of muscle pump, respiratory pump and splanchnic vasoconstriction.

vi. Blood flow to skeletal muscle increases during exercise. In resting condition, the blood supply to the skeletal muscle is 3-4ml/100 mg of the muscle/minute. It increases up to 60-80ml in moderate exercise and 90-120ml in severe exercise. This occurs as a result of sympathetic activity. Sympathetic nerves cause vasodilation in muscles.
Other factors responsible for increase in blood flow to muscles during exercise are; hypoxia, rise in temperature, potassium ions, hypercapnia etc.