NAME: EBOIGBE OSARIEMEN LILIAN

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DEPARTMENT: MEDICINE AND SURGERY

COLLEGE: MEDICINE AND HEALTH SCIENCES

**ASSIGNMENT:**

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

In long term regulation, kidneys play an important role. They regulate arterial blood pressure by two ways:

* By regulation of ECF volume
* Through rennin-angiotensin mechanism

**REGULATION OF ECF VOLUME:**

An increase in blood pressure, will cause the kidneys to excrete large amounts of water and salt by mans of pressure diuresis and pressure natriuresis. Where pressure diuresis, is the excretion of large quantities of water in urine due to increase in blood pressure. While pressure natriuresis, is the excretion of large quantities of sodium in urine. Pressure diuresis and natriuresis decreases the ECF volume and blood volume thereby, bringing arterial blood pressure back to normal level. In turn, when blood pressure decreases, there is less excretion of water but rather reabsorption of water is increased and this increases ECF volume, blood volume and cardiac output resulting in restoration of blood pressure.

**RENIN-ANGIOTENSIN MECHANISM:**

Renin is a protein enzyme released by the kidneys when the arterial pressure falls too low. In turn it raises the arterial pressure in several ways, thus helping to correct the initial fall in pressure. Renin acts on Angiotensinogen and converts it into Angiotensin I. Angiotensin I is converted into Angiotensin II by Angiotensin Converting Enzyme (ACE). Angiotensin II is a powerful vasoconstrictor and it restores blood pressure by:

* Causing constriction of arterioles in the body so that peripheral resistance is increased and blood pressure rises
* Retention of water and salts by constriction of afferent arterioles in kidneys, so that glomerular filtration reduces. This causes increase of ECF volume to normal level which in turn increases the blood pressure to normal level.
* Stimulating aldosterone secretion by adrenal glands. This hormone increases reabsorption of sodium by water reabsorption, resulting in increased ECF and blood volume. Bringing blood pressure to normal level

**2. Write short notes on the following:**

a. **Pulmonary circulation:** This is known as lesser circulation. Blood is pumped from the right ventricle to the lungs through the pulmonary artery. Exchange of gases occurs between blood and alveoli of the lungs at pulmonary capillaries. Oxygenated blood, return to the left atrium through the pulmonary veins. The left side of the heart contains oxygenate or arterial blood and the right side of the heart contains deoxygenated or venous blood

b**. Circle of Willis:** The *circle of Willis* basically a free anastomoses between the two internal carotid arteries and the two vertebral arteries which equalize pressure on the arteries of the two sides. In this way, the circulusArteriosus (circle of Willis) allows blood that enters by either internalcarotid or vertebral artery to be distributed to any part of both cerebral hemispheres.Six large arteriestaking part in the formation of circle of Willis supply by their central and cortical branches to the brain substance.

c**. Splanchnic circulation:** Splanchnic circulation includes the combined vascular beds of the intestines, pancreas, spleen and liver. The main vessels which constitute the splanchnic circulation are:

1. **Arteries**supplying the blood to the intestines, pancreas,

Spleen and liver include:

* Coeliac trunkis about 1 cm long and after arising from the abdominal aorta it divides into three main branches the left gastric artery hepatic artery and splenic artery,
* Superior mesenteric artery and
* Inferior mesenteric artery

1. **Hepatic portal system**
2. **Hepatic veins**

Splanchnic or visceral circulation constitutes threeportions:

1. Mesenteric circulation supplying blood to GI tract

2. Splenic circulation supplying blood to spleen

3. 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:** Coronary circulation is the [circulation of blood](https://en.wikipedia.org/wiki/Circulatory_system#Coronary_vessels) in the [blood vessels](https://en.wikipedia.org/wiki/Blood_vessel) that supply the [heart muscle](https://en.wikipedia.org/wiki/Cardiac_muscle) (myocardium). [Coronary arteries](https://en.wikipedia.org/wiki/Coronary_arteries) supply [oxygenated](https://en.wikipedia.org/wiki/Oxygen_saturation_(medicine)) blood to the heart muscle, and [cardiac veins](https://en.wikipedia.org/wiki/Coronary_circulation#Cardiac_veins) drain away the blood once it has been deoxygenated.  In the human heart, two coronary arteries arise from the [aorta](https://www.britannica.com/science/aorta) just beyond the semi lunar valves; during [diastole](https://www.britannica.com/science/diastole-heart-function), the increased aortic pressure above the valves forces blood into the coronary arteries and thence into the musculature of the heart. Deoxygenated blood is returned to the chambers of the heart via coronary veins; most of these converge to form the coronary [venous sinus](https://www.britannica.com/science/venous-sinus), which drains into the right [atrium](https://www.britannica.com/science/atrium-heart).

e**. Cutaneous circulation**: The cutaneous tissue has a relatively low metabolic activity compared to others tissues and organs. Therefore under normal conditions, circulation to the skin makes up about 4% of the total cardiac output. However, cutaneous circulation plays an important role in the regulation of core body temperature.

Cutaneous blood flow performs two functions:

1. Supply of nutrition to skin

2. Regulation of body temperature by heat loss.

**3. Discuss the cardiovascular adjustment that occurs during exercise?**

Adjustments to physical (muscular) exercise depend upon the type of exercise, grade of exercise, cardiac reserve (i.e. efficiency of the heart), muscle power, training, motivation and the state of nutrition. During exercise, there is an increase in metabolic needs of body tissues, particularly the muscles. Various adjustments in the body during exercise are aimed at:

1. Supply of various metabolic requisites like nutrients and oxygen to muscles and other tissues involved in exercise.

2. Prevention of increase in body temperature.

Types of exercise

Exercise may be dynamic or isotonic and static or isometric.

**Dynamic exercise**involves isotonic muscle contractions. External work is involved in this type of exercise. In this type of exercise, the heart rate, force of contraction, cardiac output and systolic blood pressure increase. However, the diastolic blood pressure is unaltered or decreased. It is because, during dynamic exercise, peripheral resistance is unaltered or decreased depending upon the severity of exercise.

**Static exercise**involves isometric muscle contractions. During this exercise, apart from increase in heart rate, force of contraction, cardiac output and systolic blood pressure, the diastolic blood pressure also increases. It is because of increase in peripheral resistance during static exercise.

Based on type of metabolism we have **anaerobic exercise** and **Aerobic exercise**

To meet the increased energy demand of muscles during exercise the primary cardiovascular response is in the form of:

* Increase in the skeletal muscle blood flow,
* Redistribution of blood flow in the body,
* Increase in the cardiac output,
* Blood pressure changes and
* Changes in the blood volume.

Skeletal muscle blood flow:

At rest the blood flow to the skeletal muscle is about 2–4 mL/100 g/min of muscle tissue. During strenuous exercise muscle blood flow can increase up to 20 times, i.e. about 50–80 mL/ 100 g/min muscle tissue. This is called exercise hyperemia*.* This tremendous increase in the muscle blood flow during exercise is made possible by:

\_ Arteriolar dilatation and

\_ Opening up of the closed capillaries which greatly increase the surface area and the rate of blood flow

Increase in cardiac output:

Normal cardiac output is about 5−6 L/min. During exercise, the cardiac output is increased depending upon the severity of exercise. In maximum exercise it may increase by five to six times. Since, cardiac output is the product of heart rate and stroke volume, an increase in both contributes to the increase in a cardiac output during exercise.

Changes in Blood Volume during Exercise: Blood volume during exercise is decreased by 15% resulting in haemoconcentration. Blood volume is decreased due to more plasma loss at the capillary level due to following reasons:

\_ Increased hydrostatic pressure in capillaries and

\_ Increased tissue fluid osmotic pressure due to accumulation of osmotically active metabolites in tissue spaces such as potassium, phosphate and lactic acid.