**OPIA PEACE ADAKWU**

**18/MHS01/314**

**MEDICINE AND SURGERY**

**PHYSIOLOGY ASSIGNMENT**

1. **DISCUSS THE LONG TERM REGULATIOM OF MEAN ARTERIAL PRESSURE**   
   In each cardiac cycle arterial blood pressure fluctuates between diastolic and systolic pressure. However, the body behaves from day to day as if it regulated the mean arterial blood pressure, which is the average between diastolic and systolic pressures. Such regulation is achieved by interdependent adjustments of only 3 parameters:
   * Heart rate (HR)
   * ventricular stroke volume (SV) and
   * total peripheral vascular resistance (TPVR).

These are related as follows:

* + HR - SV = Cardiac Output (CO); CO - TPVR = Mean Arterial Blood Pressure.

The regulatory system includes stretch-sensitive sensors, central nervous integrators/evaluators and neuro-humoral effector mechanisms. Central nervous integration and evaluation of incoming signals occurs mostly in the pons/medulla regions of the midbrain. The most important effector mechanisms are the parasympathetic and sympathetic divisions of the autonomic nervous system, the renin-angiotensin system and vasopressin.

Long-term regulation involves mainly the regulation of extracellular fluid volume by pressure natriuresis mechanisms residing in the kidney and by widespread actions of angiotensin.

Physiological mechanisms that alter arterial pressure in the long term are:-

- *The Renin-Anglotensin-Aldosterone System (RAAS).*

- *Anti-Diuretic Hormone (ADH).*

*- Atrial natriuretic peptide (ANP).*

RAAS begins with the production and release of renin from juxtaglomerular cells of the kidney. It is released in response to reduced NaCl delivery to the distal convoluted tubule, decreased blood follow to the kidney and sympathetic stimulation. It facilitates the conversion of angiotensinogen to angiotensin I which is then converted to angiotensin II using the enxyme ACE. Angiotensin II acts directly on the kidney to increase sodium reabsorption in the proximal convoluted tubule. Sodium is reabsorbed through the NaH exchanger. Angiotensin II also promotes the release of *aldosterone.* Aldosterone promotes salt and water retention andalso increases the activity of the basolateral sodium-potassium ATPase. Sodium collects in the kidney tissue and water then follows by osmosis resulting in decreased water excretion and increased blood volume and pressure.

ADH acts to increase the permeability of the collecting duct to water by inserting aquaporin channels into the apical membrane. It also stimulates sodium reabsorption from the thick ascending limb of the loop of Henle, thereby increasing water reabsorption and causing the plasma volume to increase, decreasing osmolarity as well.

ANP is released when the atria are stretched (this indicates high blood pressure). It helps promote sodium excretion, therefore ANP secretion is low when blood pressure is low and high when blood pressure is high.

1. **WRITE SHORT NOTES ON THE FOLLOWING;**
   * 1. **PULMONARY CIRCULATION:** The **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 the pulmonary arteries  and the pulmonary veins.
     2. **CIRCLE OF WILLIS:** The CircleofWillis is the joining area of several arteries at the bottom (inferior) side of the brain. At the Circle ofWillis, the internal carotid arteries branch into smaller arteries that supply oxygenated blood to over 80% of the cerebrum. The circleofWillis is a part of the cerebral circulation and is composed of the following arteries: ... Internal carotid artery (left and right) Posterior cerebral artery (left and right) Posterior communicating artery (left and right).It helps blood flow from both the front and back sections of the brain. The circleofWillis gets its name from the physician Thomas Willis, who described this part of the anatomy in 1664.
     3. **SPLANCHIC CIRCULATION :** Splanchnic is usually used to describe organs in the abdominal cavity. It is used when describing: Splanchnic tissue. Splanchnicorgans - including the stomach, small intestine, large intestine, pancreas, spleen, liver, and may also include the kidney. Also know as mesenteric circulation. The splanchniccirculation consists of the blood supply to the gastrointestinal tract, liver, spleen, and pancreas. It consists of two large capillary beds partially in series. The small splanchnic arterial branches supply the capillary beds, and then the efferent venous blood flows into the PV.
     4. **CORONARY CIRCULATION:** Coronarycirculation is the circulation of blood in the blood vessels that supply the heart muscle (myocardium). Coronaryarteries supply oxygenated blood to the heart muscle, and cardiac veins drain away the blood once it has been deoxygenated. From the tissue capillaries, the deoxygenated blood returns through a system of veins to the right atrium of the heart. The coronaryarteries are the only vessels that branch from the ascending aorta. The brachiocephalic, left common carotid, and left subclavian arteries branch from the aortic arch.
     5. **CUTANEOUS CIRCULATION:** The cutaneous circulation is the circulation and blood supply of 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 through will flow through **arteriovenous anastomoses (AVAs)** instead of capillaries. AVAs serve a role in temperature regulation. AVAs are low-resistance connections between the small arteries and small veins that supply and drain the skin. These allow the shunt of blood directly into the **venous plexus** of the skin, without it passing through capillaries. Since AVAs contain no capillary section, they are not involved in transport of nutrients to/from the tissues, but instead play a major role in temperature regulation. The skin is the body’s main heat dissipating surface: the amount of blood flow to the skin determines the degree of heat loss and therefore the core body temperature. The blood flow through AVAs is heavily influenced by the **sympathetic nervous system.**  At rest, the sympathetic nervous system dominates and acts to constrict AVAs. Any changes in core temperature are detected by the thermoregulatory centre in the **hypothalamus**. It regulates temperature by altering the level of sympathetic outflow to the cutaneous vessels, to return temperature to its normal range.
2. **DISCUSS THE CARDIOVASCULAR ADJUSTMENT THAT OCCURS DURING EXERCISE.**

1).An increase in **cardiac** output or the pumping capacity of the heart, designed to enhance the delivery of oxygen and fuel to the working muscles.

2). There is also an increase in stroke volume due to an increase in end-diastolic cardiac size and a decrease in end-systolic cardiac size. The reduction in end-systolic dimension can be attributed to increased contractility.

3). Blood flow to the heart also increases, reflecting the metabolic requirements of the myocardium.

Visceral flow is normally maintained during severe exercise as long as compensatory mechanisms are intact.