ASSIGNMENT

1.DISCUSS THE LONG TERM REGULATION OF MEAN ARTERIAL PRESSURE

Mean arterial pressure is an average blood pressure in an individual during a single cardiac cycle, it is considered a better indicator of perfusion to vital organs than systolic blood pressure, it is within the range of 70-100mmHg. There are three important factors that affect mean arterial pressure: cardiac output, total peripheral resistance and blood volume. Mean arterial pressure is regulated by changes in cardiac output and systemic vascular resistance.

Long term regulation of mean arterial pressure involves kidneys and endocrine system, it mainly involves volume receptor reflex, there are several physiological mechanisms that regulate blood pressure in the long-term, they include:

- Renin-Angiotensin-Aldosterone System (RAAS)
  Renin is a peptide hormone released by the granular cell of the juxtaglomerular apparatus in the kidney. It is released in response to sympathetic stimulation. Renin facilitates the conversion of angiotensinogen to angiotensin I which is then converted to angiotensin II using angiotensin-converting enzyme (ACE). 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 collect in the kidney tissue and water then follows by osmosis, this results in decreases water excretion and therefore increased blood volume and thus blood pressure.

- Anti-Diuretic Hormone (ADH)
  ADH acts to increase the permeability of the collecting duct to water by inserting aquaporin channels into the apical membrane, it also stimulates the sodium reabsorption from the thick ascending limb of the loop of Henle. This increases water reabsorption thus increasing plasma volume and decreasing osmolarity.

Other factors that can affect long-term regulation of blood pressure are natriuretic peptides these includes:

- 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 inhibits

sodium reabsorption along the nephron, conversely the ANP secretion is low when blood pressure is low

- Prostaglandins acts 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.

CLINICAL SIGNIFICANCE

The role of arterial pressure is to maintain a high enough pressure that allows for proper perfusion of body tissue and organs, but not so high as to cause bodily harm. When the body enters a state of acute hypotension, the baroreflex function attempts to return arterial pressure to its stable state to allow continuous perfusion, the term for this condition is ESSENTIAL HYPERTENSION.

2.Write short notes on the following
Pulmonary circulation
Circle of willis
Splanchnic circulation
Coronary circulation
Cutaneous circulation

PULMONARY CIRCULATION: The pulmonary circulation is the portion of circulatory system which carries deoxygenated blood away from the right ventricle, to the lungs and returns deoxygenated blood to the left atrium and ventricle of the heart, deoxygenated blood from the lower half of the body enters the heart from the inferior vena cava while deoxygenated blood from the upper body is delivered to the heart via the superior vena cava. Both the superior vena cava and the inferior vena cava empty blood into the right atrium, blood flows through the tricuspid valve into the right ventricle. It then flows through the pulmonic valve into the pulmonary artery before delivered to the lungs, while in the lungs, blood diverges into the numerous pulmonary capillaries where it releases carbon dioxide and is replenished with oxygen. Once it is fully saturated with oxygen the blood is transported via the pulmonary vein into the left atrium which pumps blood through the mitral valve and into the left ventricle.

CIRCLE OF WILLIS: The circle of willis is the joining area of several arteries at the bottom (inferior side of the brain), it is a circulatory anastomosis that supplies blood to the brain and surrounding structures. The circle of willis is composed of the follow ing arteries:

Anterior cerebral artery (left and right)

Anterior communicating artery

Internal carotid artery (left and right)

Basilar artery

Posterior cerebral artery (left and right). The arrangement of the brain's arteries into the circle of willis creates redundancy for collateral circulation in the cerebral circulation. If one of the circle becomes blocked or narrowed blood flow from the other blood vessels can often preserve the cerebral perfusion well enough to avoid the symptoms of ischemia. The circle of willis plays an important role as it allows for proper blood flow from the arteries to both the front and back hemispheres of the brain.

SPLANCHNIC CIRCULATION: The splanchnic circulation consists of the blood supply to the gastrointestinal tract originating at the celiac trunk, the superior mesenteric artery. The splanchnic organs include the stomach, small intestine, pancreas, spleen and liver. The three major arteries that supply the splanchnic organs are the celiac and superior and inferior mesenteric gives rise to smaller arteries that anastomose extensively. The splanchnic bed forms an important circulatory reservoir, which can be mobilized during periods of physiological stress. Disorders of the splanchnic circulation may contribute to the multi-organ dysfunction syndrome and vice versa.

CORONARY CIRCULATION: This is the circulation of blood in the blood vessels that supply the heart muscle (myocardium). Coronary arteries supply oxygenated blood to the heart muscle and cardiac veins drain away the blood once it has been deoxygenated. In the human heart two coronary arteries arise from the aorta just beyond the semilunar valves. The major coronary arteries are

Right coronary artery

Left coronary artery

Left circumflex artery

Left anterior descending artery. Obstruction of a coronary artery, depriving the heart tissue of oxygen-rich blood, leads to death of part of the heart muscle (myocardial infraction) in severe cases and total heart failure and death may ensue.

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.

3.DISCUSS THE CARDIOVASCULAR ADJUSTMENT THAT OCCURS DURING EXERCISE?

Heart rate change during exercises: The acceleration of the heart is observed immediately following the exercise, a short rise of heart rate is observed at first minute of exercise but after that this rate of rise is slight decreased. Within 4 to 5 minutes of exercise the maximal rise is more or less achieved. With onset of exercise the rise of heart rate may be due to:

- Reflexes originating in the receptors of moving joints or contracting muscle.
- Stimulation of chemoreceptors in muscles by the acid metabolites.

- Sympathetico-adrenal activation causing section of much larger amounts of epinephrine in the blood.

Cardiac Output: During exercise the cardiac output is greatly increased, the exercise in cardiac output during exercise is the result of the increase in stroke volume and heart rate. The diastolic size of the heart is decreased during exercise so that the increased stroke volume cannot be caused by greater stretching.

Venous Return: Venous return is greatly increased during exercise for the following reasons:

- Massaging action of skeletal muscles: During exercise the alternate contraction and relaxation of the muscle acts as a booster pump for flowing blood towards the heart.
- Respiratory movements: Respiratory movements exert a sucking effect over the right heart and great veins so that greater venous return may occur.

Contraction of Limb veins: It is claimed that limb veins undergo reflex vasoconstriction during exercise thus facilitating rapid venous return to the heart.

Blood Pressure: Blood pressure is raised with the onset of exercise there may be an anticipatory blood pressure due to nerve impulses originating from the cerebral cortex to the medullary cardiac and vasoconstrictor centers.

Circulatory Status during exercise: During exercise the circulation is adjusted in such a way that the active muscles as well as the vital organs get blood supply to a greater proportion than that of the inactive organs and non-vital organs, during exercise sudden lack of O_2 caused the increased accumulation of CO_2, lactic acid, adenosine and histamine. These substances may cause hyperaemia and thus the resistance to blood flow is decreased, as the work load of heart is increased tremendously during exercise.

Other changes include:

- Increase in contractility.
- Stimulation of sympathetic fibre.

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cvphysiology.com
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