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PHYSIOLOGY ASSIGNMENT

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

This is known as the renal mechanism for regulation of blood pressure because the kidneys play an impotant role here. When blood pressure alters slowly in several days, months or years, the nervous mechanism adapts to the altered pressure and loses the sensitivity for the changes and it cannot regulate the pressure any more. In such conditions, the renal mechanism operates efficiently to regulate the blood pressure. Therefore, it is called long-term regulation. The kidneys regulate arterial blood pressure in two ways :

***By regulation of ECF volume**

Here,when blood pressure increases, kidneys excrete large amounts of water and salt, particularly sodium by the means of pressure diuresis and pressure natriuresis. Pressure diuresis is the excretion of large quantity of water in urine because of increased blood pressure. Pressure natriuresis is the excretion of large quantity of sodium in urine. Because of this, 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 reabsorption of water from renal tubules is increased. This in turn, increases ECF volume and cardiac output, resulting in restoration of blood pressure.

***Through renin-angiotensin mechanism**

-Action 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). It actsin two ways to restore the blood pressure:

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

ii.Simultaneously, angiotensin II stimulates the adrenal cortexto secrete aldosterone. This hormone 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.

-Actions of Angiotensin III and Angiotensin IV

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

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

a) **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 term pulmonary circulation is readily paired and contrasted with the systemic circulation. The vessels of the pulmonary circulation are the pulmonary arteries and the pulmonary veins. A separate system known as the bronchial circulation supplies oxygenated blood to the tissue of the larger airways of the lungs.

b) **Circle of Willis**

The circle of Willis also called Willis' circle, loop of Willis, cerebral arterial circle, and Willis polygon is a circulatory anastomosis that supplies blood to the brain and surrounding structures. It is named after Thomas Willis, an English physician. The circle of Willis is a part of the cerebral circulation and 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)

Posterior communicating artery (left and right)

The middle cerebral arteries, supplying the brain, are not considered part of the circle of Willis.

c) **Splanchnic circulation**

The splanchnic circulation is composed of the blood flow originating from the celiac, superior mesenteric, and inferior mesenteric arteries and is distributed to all abdominal viscera. The splanchnic circulation receives over 25% of the cardiac output and contains a similar percentage of the total blood volume under normal conditions. Thus, the splanchnic circulation can act as a site of regulation of distribution of cardiac output and also as a blood reservoir.

d) **Coronary circulation**

Coronary circulation is the circulation of blood in the blood vessels that supply the heart muscle. Coronary arteries supply oxygenated blood to the heart muscle, and cardiac veins drain away the blood once it has been deoxygenated. Because the rest of the body, and most especially the brain, needs a steady supply of oxygenated blood that is free of all but the slightest interruptions, the heart is required to function continuously. Therefore its circulation is of major importance not only to its own tissues but to the entire body and even the level of consciousness of the brain from moment to moment. Interruptions of coronary circulation quickly cause heart attacks, in which the heart muscle is damaged by oxygen starvation.

e) **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 instead of capillaries. Arteriovenous anastomoses serve a role in temperature regulation.

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

Heart rate increases during exercise because of impulses from cerebral cortex to medullary centers, which reduces vagal tone. Cardiac output increases up to 20 L/min in moderate exercise and up to 35L/min during severe exercise. Increase in cardiac output is directly proportional to the increase in the amount of oxygen consumed during exercise. Venous return increases remarkably because of muscle pump, respiratory pump and splanchnic vasoconstriction.