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DEPARTMENT: MEDICINE AND SURGERY

COURSE: PHYSIOLOGY

ASSIGNMENT

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

Arterial pressure is continuously monitored by various sensors located within the body. Whenever arterial pressure varies from normal, multiple reflex responses are initiated, which cause the adjustments in cardiac output, and total peripheral resistance needed to return arterial pressure to its normal value. The regulation of mean arterial blood pressure within a range of values consistent with health is mediated by two responses; short-term and long term regulations.

In the long term regulation (minutes to days), mechanisms such as changes in cardiac output brought about by changes in blood volume play an increasingly important role in the control of arterial pressure. It is concerned with the balance between extracellular fluid and blood volume on one hand and the renal mechanisms controlling urine output on the other hand.

Renal urine output involves pituitary adrenal cortical mechanisms which control water and sodium excretion by the kidney. Disturbances during this process may result in gradual increase in arterial pressure called hypertension. The cardiovascular centers control arterial blood pressure through adjustments of cardiac output and peripheral resistance.

The long term regulation is believed to be dependent mainly on the blood urinary volume- urinary output balance which in turn is mainly influenced by the renin-angiotensin-aldosterone system. Studies in hypertensive have suggested that the long-term-controlled variable is not arterial blood pressure, but the balance between intake and output of fluid and electrolytes. If the kidney requires a higher perfusion pressure to achieve that balance, then daily blood pressure regulation occurs around an appropriately higher set point.

2. Write short notes on the following:

a. **Pulmonary circulation-** is the system of transportation that shunts de-oxygenated blood from the heart to the longs to be re-saturated with oxygen before being dispersed into systemic circulation. It conducts the entire cardiac output with a remarkably low driving pressure from the pulmonary artery to the left atrium. It provides the gaseous exchanges between the pulmonary alveoli and capillaries; this circuit extends from the heart to the lungs and back to the heart; 100% of cardiac output goes through it.

b. **Circle of willis-** consists of the arterial network located at the base of the skull allowing arterial blood flow exchange between the anterior and posterior circulation, and between the left and right hemispheres. It is formed by the anastomosis of the two internal carotid arteries with the two vertebral arteries. It describes the ring of blood vessels in the base of the brain that connects the main intracerebral blood vessels. It is incomplete in most individuals, although wide variations exist.

c. **Splanchnic circulation-** is composed of the blood flow originating from the celiac, superior mesenteric, and inferior mesenteric arteries and is distributed to the gastrointestinal tract, liver, spleen and pancreas. It receives over 25% of the cardiac output and contains a similar % of the total blood volume under normal conditions. Thus, it can act as a site of regulation of distribution of cardiac output and also as a blood reservoir.

d. **Coronary circulation-** supplies blood to and provides drainage from the tissues of the heart. In the heart, two coronary arteries arise from the aorta; during diastole, 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, which drains into the right atrium.

e. **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 from other tissues. Some of the circulating blood volume in the skin will flow through arteriovenous anastomoses (AVAs) instead of capillaries. AVAs serve a role in temperature regulation. The amount of blood flow to the skin determines the degree of heat loss and therefore, the core body temperature.

3. Discuss the cardiovascular adjustment that occurs during exercise

During exercise, cardiac output increases to provide the blood flow needed to serve the contracting skeletal muscles. Also, as the body temperature increases, so does blood supply to the skin. By resetting the operating point for the arterial baroreceptors, vasodilatation is regulated to make blood pressure stable and to increase during exercise. The central nervous system and neural feedback from contracting muscles are important for the blood pressure response to exercise.