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18/MHS01/1771

Department

Medicine and Surgery (MHS)

Course

Physiology (PHS 201)

Assignment Questions

1. Discuss the long-term regulation of mean arterial blood pressure
2. Write short notes on the following:
a. Pulmonary circulation
b. Circle of Willis
c. Splanchnic circulation
d. Coronary circulation
e. Cutaneous circulation
3. Discuss the cardiovascular adjustment that occurs during exercise

Answers

1. Long term regulation of mean arterial blood pressure: Mean arterial blood pressure is the average between diastolic and systolic pressures. The body behaves from day to day as if it regulated the mean arterial blood pressure, 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.

2a. Pulmonary circulation: This is also referred to as lesser circulation and it is the type of blood circulation that occurs between the heart and the lungs. When deoxygenated blood or venous blood is brought into the heart, specifically the right atrium through the vena cava, it is pumped out of the heart and carried by the pulmonary artery to the lungs to pick up oxygen. In the lungs specifically the alveoli, gaseous exchange of oxygen into the blood and carbon dioxide out of the blood occurs. The now oxygenated or arterial blood is then carried by pulmonary vein back into the heart to be pumped out of to the rest of the body tissues.

2b. Circle of Willis: This is a ring of interconnecting arteries located at the bottom part of the brain. It is formed by the anastomoses of the two internal carotid arteries with the two vertebral arteries. It helps blood flow from both the front and back sections of the brain. The circle of Willis gets its name from the physician, Thomas Willis who described this part of anastomosis of the two internal carotid arteries with the two vertebral arteries. All principal arteries that supply cerebral hemispheres of the brain branch off from the circle of willis a.k.a circulus arteriosus.

2c. Splanchnic circulation: This is the part of systemic or greater circulation that involves blood circulation within the splanchnic organs/tissues. The splanchnic organs are organs found in the abdominal cavity. They include; stomach, liver, pancreas, spleen, small intestine, large intestine and sometimes kidney. Therefore, splanchnic circulation is the blood flow to these abdominal gastrointestinal organs.

2d. Coronary circulation: This is basically the circulation of blood within the blood vessels i.e. coronary arteries and cardiac veins that supply the muscles of the heart.

2e. Cutaneous circulation: This is the blood supply to the skin. Some of the blood volume in the skin will flow through arteriovenous anastomoses (AVAs) instead of capillaries. The cutaneous tissue has relatively low metabolic activity compared to other tissues and organs. In normal conditions, circulation to the skin makes up about 4% of the total cardiac output

3.Cardiovascular adjustments that occur during exercise

- There is an increase in heart rate(bpm) and stroke volume(ml/min) which leads to an increase in cardiac output because it a product of both. It is important for this to occur to enhance delivery of oxygen and fuel to working muscles
- There is an increase in blood flow to working muscles via dilation of local arterioles and constriction of venous capacitance
- There is a decrease in blood flow to kidneys, liver and guts thereby redirecting blood to the working muscles
- There is a rapid withdrawal of parasympathetic stimuli and increase in sympathetic nervous activity. This depends solely on intensity of exercise.
- There is an increase in circulating epinephrine or adrenaline hormone