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SCIENCES

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ASSIGNMENT

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

In the cardiovascular system, blood flow is controlled by arterial blood pressure, and in this way the long term mean blood pressure is stabilized to regulate oxygen and carbon dioxide levels. Thereafter the bar reflex would stabilize would stabilize the instantaneous pressure value to the prevailing carotid pressure (MAP). In each cardiac cycle arterial blood pressure fluctuates between diastolic and systolic pressures. Such regulation is achieved by interdependent adjustments of only 3parameters: Heart rate (HR), ventricular stroke volume(SV) and total peripheral vascular resistance(TPVR)= Mean arterial blood pressure. The regulatory system includes stretch-sensitive sensors, central nervous integrators/evaluators and neuro-humoral effector mechanisms. The most important effector mechanisms are the parasympathetic and sympathetic divisions of the autonomic nervous system, the rennin 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.

2. Write short note on the following
    a. Pulmonary circulation
    b. Circle of Willis
    c. Splanchnic circulation
    d. Coronary circulation
    e. Cutaneous circulation

a. Pulmonary circulation is the circulation or flow of blood between the heart and lungs. It is the system of transportation that shunts deoxygenated blood from the heart to the lungs to be re-saturated with oxygen before being dispersed into systemic circulation. 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 and 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 being 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 fully saturated with oxygen, the blood is transported via the pulmonary vein into the left atrium which pumps blood through the mitral valve into the left ventricle expels oxygen rich blood through the aortic valve and into the aorta.

b. The circle of Willis is a ring of interconnecting arteries located at the base of the brain around the optic chiasm or chiasma (partial crossing of the optic nerve-CNII; this crossing is important for binocular vision), infundibulum of the pituitary stalk and the hypothalamus. This arterial ring provides blood to the brain and neighboring structures. Polygonal anastomotic shape offers the possibility of alternate pathways for the blood flow, which is essential for the brain functioning, since it is the structure that is mostly sensitive to hypoxia.

c. The term splanchnic circulation describes the blood flow to the abdominal gastrointestinal organs including the stomach, liver, spleen, pancreas, small intestine and large intestine. It comprises three major branches of the abdominal aorta; the celiac artery; superior mesenteric artery (SMA); and inferior mesenteric artery (IMA). The arterial supply to the splanchnic bed comprises three divisions of the abdominal aorta; the celiac artery; and the superior and inferior mesenteric arteries. Under physiological conditions, blood flow in the splanchnic circulation is controlled via intrinsic (myogenic and metabolic) and extrinsic (autonomic and humoral) mechanisms. 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. A number of techniques used in anesthesia and critical care influence the distribution of blood flow in the splanchnic circulation.

d. Coronary circulation is the circulation of blood within the heart. It is part of the systemic circulatory system that supplies blood to and provides drainage from the tissues of the heart. In the human heart, two coronary arteries arise from the aorta just beyond the semi lunar valves; 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. The heart normally extracts 70 to 75 percent of the available oxygen from the blood in the coronary circulation, which is much more than the amount extracted by other organs from their circulation. Obstruction of a coronary artery, depriving the heart tissue of oxygen-rich blood, leads to death of part of the heart muscle (myocardial infarction) in severe cases, and total heart failure and death may ensue.

e. 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 circulation blood volume in the skin will flow through arteriovenous anastomoses (AVAs) instead of capillaries. AVAs serve a role in temperature regulation.

3. Discuss the cardiovascular adjustment that occurs during exercise?

The integrated response to severe exercise involves fourfold to fivefold increases in cardiac output, which are due primarily to increases in cardiac rate and to a lesser extent to augmentation of stroke volume. The increase in stroke volume is partly due to an increase in end-diastolic cardiac size (Frank-Starling mechanism) and secondarily due to a reduction in end-systolic cardiac size. The reduction in end-systolic dimensions can be related to increased contractility, mediated by beta adrenergic stimulation which blockade prevents the inotropic response, the decrease in end-systolic dimensions and approximately 50% of the tachycardia of exercise. The enhanced cardiac output is distributed preferentially to the exercising muscles including the heart. Blood flow to the inactive viscera (e.g., kidney and gastrointestinal tract) is maintained during severe exercise in the normal dog. It is suggested that local auto regulatory mechanisms are responsible for maintained visceral flow in the face of neural and hormonal autonomic drive, which acts to constrict renal and mesenteric vessels and to reduce blood flow. However, in the presence of circulatory impairment, where oxygen delivery to the exercising muscles is impaired as occurs to complete heart block where normal heart rate increases during exercise are prevented, or in congestive right heart failure, where normal stroke volume increases during exercise are impaired, or in the presence of severe anemia, where oxygen carrying capacity of the blood is limited, visceral blood flows are reduced drastically and blood is diverted to the exercising musculature. Thus, visceral flow is normally maintained during severe exercise as long as all other compensatory mechanism is disrupted (even the elimination of splenic reserve in the dog0, reduction and diversion of visceral flow occur.