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Matric no. : 18/mhs01/353

Dept: medicine and surgery

Course: medical physiology

Assignment 1

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: when blood pressure alters slowly in several days/ months/ years, the nervous mechanism adapts to the altered pressure and loses the sensitivity for the changes. It cannot regulate the pressure anymore. In such conditions, the renal mechanism operates efficiently to regulate the blood pressure. Kidney plays an important role in long term regulation by two ways; regulation of ECF volume and through renin-angiotensin mechanism.

Regulation of ecf volume is done through pressure diuresis(excretion of large quantity of water in urine because of increased blood pressure) and natriuresis (excretion of large quantity of sodium in urine). These causes a decrease in ecf volume and blood volume which in turn brings the arterial blood pressure back to normal level. To increase ecf volume,blood volume and cardiac output there is an increase in reabsorbtion of water by renal tubules.

Renin-angiotensin mechanism involves actions of angiotensin II and actions of angiotensin III and angiotensin IV. Angiotensin II restores blood by constriction of arterioles in the body so peripheral resistance is increased and blood pressure rises also by stimulating the adrenal cortex to secrete aldosterone.

2.) Pulmonary circulation: is the portion of the circulatory system which carries carries oxygenated 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 otherwise called lesser circulation.

b.)Circle of willis : is formed by branches of vascular artery and internal carotid artery through which brain receives blood . It plays an important role, as it allows for proper blood flow from the arteries to both the front and back hemispheres of the brain. The arteries that stem off from the circle of Willis supply much of the blood to the brain.The circle of Willis also serves as a sort of safety mechanism when it comes to blood flow. If a blockage or narrowing slows or prevents the blood flow in a connected artery, the change in pressure can cause blood to flow forward or backward in the circle of Willis to compensate.This mechanism could also help blood flow from one side of the brain to the other in a situation in which the arteries on one side have reduced blood flow. In an emergency, such as a stroke, this may reduce the damage or aftereffects of the event. Importantly, the circle of Willis does not actively carry out the function. Instead, the natural shape of the circle and the way that pressure acts in the area simply allow for bidirectional blood flow when necessary.

c.)splanchnic circulation: also knows as visceral circulation constitutes; mesenteric circulation supplying blood to GI tract, splenic circulation supplying blood to spleen, hepatic circulation supplying blood to liver. Unique feature of splanchnic circulation is that the blood from mesenteric bed and spleen forms a major amount of blood flowing to liver. Blood flows to liver from GI tract and spleen through portal system.

d.) Coronary circulation: is the circulation of blood in the blood vessels that supply theppl myocardium. Coronary arteries supply oxygenated blood to the heart muscle, and coronary 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. Such interruptions are usually caused by ischemic heart disease and sometimes by embolism from other causes like obstruction in blood flow through vessels.

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 to that of other tissues. Some of the circulating blood volume in the skin will flow through arteriovenous anastomoses (AVA' s) instead of capillaries. AVAs serve a role in temperature regulation.

3.) 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 full role of the Frank-Starling mechanism is masked by the concomitant tachycardia. The reduction in end-systolic dimensions can be related to increased contractility, mediated by beta adrenergic stimulation. Beta adrenergic 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 heart increases fourfold to fivefold as well, mainly reflecting the augmented metabolic requirements of the myocardium due to near maximal increases in cardiac rate and contractility. 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 anaemia, 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 mechanisms remain intact. However, when any other compensatory mechanism is disrupted (even the elimination of splenic reserve in the dog), reduction and diversion of visceral flow occur.