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Questions

1. Discuss the long term regulation of mean arterial blood pressure
2. Write short notes on the following:

* Pulmonary circulation
* Circle of willis
* Splanchnic circulation
* Coronary circulation
* Cutaneous circulation

3.Discuss the cardiovascular adjustment that occurs during exercise.

Answers

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

Mean arterial blood pressure is the average pressure existing in the arteries. It is not the arithmetic mean of systolic and diastolic pressures. It is the diastolic pressure plus one third of pulse pressure. In determining mean pressure, diastolic pressure is considered than systolic pressure because the diastolic period of cardiac cycle is longer than the systolic period.

Kidneys play important role in long-term regulation of arterial blood pressure. The renal mechanism operates efficiently to regulate the blood pressure in two ways:

* By Regulation of ECF Volume:

When the blood pressure increases, kidneys excrete large amounts of water and salt, particularly sodium, by means of **pressure diuresis** and pressure natriuresis. Pressure Diuresis is the excretion of large quantity of water in urine because of increased blood pressure, even a slight increase in blood pressure doubles the water excretion. Pressure Natriuresis is the excretion of large quantity of sodium in urine. Because of diuresis and natriuresis, 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, which in turn increases ECF volume, blood volume and cardiac output, resulting in restoration of blood pressure.

* Through Renin-Angiotensin Mechanism:

Actions of Angiotensin ll

When blood pressure and ECF volume decrease, rennin secretion from kidneys is increased. It converts angiotensinogen into angiotensin l. This is converted into angiotensin ll by ACE ( Angiotensin-Converting Enzyme).

Angiotensin ll causes constriction of arterioles in the body so that the peripheral resistance is increased and blood pressure rises. Simultaneously, angiotensin ll stimulates the adrenal cortex to secrete aldosterone.

Actions of Angiotensin lll and Angiotensin lV: Angiotensin lll and Angiotensin lV also increase the blood pressure and stimulate adrenal cortex to secrete aldosterone.

1. Write short notes on the following:

a. Pulmonary Circulation

In pulmonary circulation also known as lesser circulation, blood is pumped from right ventricles to lungs through pulmonary artery. This circulation involves movement of deoxygenated blood from the heart to the lungs where it becomes oxygenated. The right ventricles pumps out deoxygenated blood into the pulmonary artery and carries the blood to the lungs. After adding oxygen to the blood and removing carbon dioxide, blood is returned to the heart through the pulmonary vein into the left atrium. At the pulmonary arteries, exchange of gases occurs between blood and alveoli of the lungs. Oxygenated blood returns to left atrium through the pulmonary veins.

b. Circle of Willis

Circle of willis is formed from branches of Basilar artery and Internal carotid artery which delivers blood to the brain. The circle of willis is the joining area of several arteries at the bottom (inferior) side of the brain. At the Circle Of Willis, the internal carotid arteries branch into smaller arteries that supply oxygenated blood to over 80% of the cerebrum.

c. Splanchnic Circulation

Splanchnic circulation also known as Visceral circulation constitutes three portions of circulation of blood to the gastrointestinal tract, spleen and the liver. The special feature of Splanchnic circulation is that the blood from mesenteric bed and spleen forms a major amount of bloof flowing to the Liver. Blood flows to Liver from Gastrointestinal tract and Spleen through portal system.

Mesenteric Circulation: Supplies blood to the gastrointestinal tract and is regulated by local auto regulation, activity of gastrointestinal tract, nervous factors and chemical factors.

Splenic Circulation: Supplies blood to the spleen and is regulated by sympathetic nerve fibers.

Hepatic Circulation: Supplies blood to the liver and is regulated by systemic blood pressure, splenic contraction, movements of intestine, chemical factors and nervous factors.

d. Coronary Circulation

Coronary circulation is the circulation of blood vessels that supply the heart muscle (myocardium). Coronary arteries supply oxygenated blood to the heart muscle, and cardiac veins drain away the blood once it has been deoxygenated.

Applied Physiology

* Coronary Occlusion: It is the partial or complete obstruction of the coronary artery
* Myocardial Ischemia and Necrosis: It is the reaction of a part of myocardium in response to hypoxia.
* Angina Pectoris: It is the chest pain that is caused by myocardial ischemia.

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. Cutaneous blood flow is regulated mainly by body temperature and HYPOTHALAMUS plays an important role in regulating cutaneous blood flow. Cutaneous blood flow helps in supply of nutrition to skin and regulation of body temperature by heat loss.

Applied Physiology

* White reaction: It is the reaction of the blood vessels in skin to a mechanical stimulus.
* Lewis triple response: It is the vascular response of skin that includes three consecutive reactions of blood vessels of skin to a mechanical stimulus.

1. Discuss the cardiovascular adjustments that occurs during exercise:
2. Heart Rate: Resting heart rate averages 60 to 80 beats per minute while in athletes heart rate is as low as 28 to 40 beats per minute. During exercise such as running, the heart rate increases, moving from its average point to points higher and as for Athletes, during exercise their heart rate is normal i.e 60 to 80 beats per minute.
3. Stroke Volume: It is the amount of blood ejected per beat from left ventricle and measured in ml per beat. Stroke volume increase proportionally with exercise intensity. Average stroke volume in untrained individuals is 50 to 70ml/beat but during exercise increases to 110-130ml/beat. In athletes, average stroke volume is 90-110ml/beat increasing to 150-220ml/beat during exercise.
4. Cardiac Output: It is the amount of blood pumped by the in one minute measured in L/min. It is the product of heart rate and stroke volume. If heart rate or stroke volume or both increases, cardiac output increases as well. During maximal exercise, cardiac output increases significantly.
5. Blood Flow: The vascular system can redistribute blood to those tissues with the greatest immediate demand for energy such as muscles (skeletal muscles receives a greater blood supply). At rest 15-20% of circulating blood supplies skeletal muscle and during vigorous exercise, it increases to 80-85% of cardiac output.
6. Blood Pressure: At rest, a typical systolic blood pressure in a healthy individual ranges from 110-140mmHg and 60-90mmHg for diastolic blood pressure. During exercise, systolic pressure increases to over 200mmHg in highly trained and healthy athletes.