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MATRIC NO.: 18/MHS01/366

DEPT. MEDICINE AND SURGERY

COLLEGE: MHS

LEVEL: 200 LEVEL

COURSE: PHYSIOLOGY
ASSIGNMENT

1) **Discuss the long-term regulation of mean arterial blood pressure;**

   1. The long-term level of arterial pressure is dependent on the relationship between arterial pressure and the urinary output of salt and water, which, in turn, is affected by a number of factors, including renal sympathetic nerve activity (RSNA). In the present brief review, we consider the mechanisms within the brain that can influence RSNA, focusing particularly on hypothalamic mechanisms. The paraventricular nucleus (PVN) in the hypothalamus has major direct and indirect connections with the sympathetic outflow and there is now considerable evidence that tonic activation of the PVN sympathetic pathway contributes to the sustained increased level of RSNA that occurs in conditions such as heart failure and neurogenic hypertension. The tonic activity of PVN sympathetic neurons, in turn, depends upon the balance of excitatory and inhibitory inputs. A number of neurotransmitters and neuromodulators are involved in these tonic excitatory and inhibitory effects, including glutamate, GABA, angiotensin II and nitric oxide. The dorsomedial hypothalamic nucleus (DMH) also exerts a powerful influence over sympathetic activity, including RSNA, via synapses with sympathetic nuclei in the medulla and, possibly, also other brainstem regions. The DMH sympathetic pathway is an important component of the phasic sympathoexcitatory responses

associated with acute stress, but there is no evidence that it is an important component of the central pathways that produce long-term changes in arterial pressure. Nevertheless, it is possible that repeated episodic activation of this pathway could lead to vascular hypertrophy and, thus, sustained changes in vascular resistance and arterial pressure. 4. Recent studies have reactivated the old debate concerning the possible role of the baroreceptor reflex in the long-term regulation of sympathetic activity. Therefore, central resetting of the baroreceptor-sympathetic reflex may be an important component of the mechanisms causing sustained changes in RSNA. However, little is known about the cellular mechanisms that could cause such resetting.

2) Write short note on the following;

- **Pulmonary circulation;**

The pulmonary circulation is the portion of the circulatory system which carries deoxygenated 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 readily paired and contrasted with the systemic circulation. The vessels of the pulmonary circulation are the pulmonary arteries and the pulmonary veins. Deoxygenated blood leaves the heart, goes to the lungs, and then re-enters the heart; Deoxygenated blood leaves through the right ventricle through the pulmonary artery. From the right atrium, the blood is pumped through the tricuspid valve (or right atrioventricular valve), into the right ventricle. Blood is then pumped from the right ventricle through the pulmonary valve and into the main pulmonary artery. The oxygenated blood then leaves the lungs through pulmonary veins, which return it to the left part of the heart, completing the pulmonary cycle. From the right ventricle, blood is pumped through the semilunar pulmonary valve into the left and right main pulmonary arteries (one for each lung), which branch into smaller pulmonary arteries that spread throughout the lungs.

- **Circle of willis;**

Structure;

The circle of Willis is a part of the cerebral circulation and is composed of the following arteries;

Anterior cerebral artery (left and right), Anterior communicating artery

Internal carotid artery (left and right), Posterior cerebral artery (left and right)

Posterior communicating artery (left and right).

Origin of arteries;

The left and right internal carotid arteries arise from the left and right common carotid arteries. The posterior communicating artery is given off as a branch of the internal carotid artery just before it divides into its terminal branches - the anterior and middle cerebral arteries. The anterior cerebral artery forms the anterolateral portion of the circle of Willis, while the middle cerebral artery does not contribute to the circle. The right and left posterior cerebral arteries arise from the basilar artery, which is formed by the left and right vertebral arteries. The vertebral arteries arise from the subclavian arteries.

- **Splanchnic circulation;**

The splanchnic circulation powerfully influences systemic arterial pressure via two distinct mechanisms. Widespread contraction of arteries in the splanchnic bed reduces blood flow to the region. The low oxygen consumption of splanchnic organs allows for a very large reduction in blood flow without producing ischemia. Arterial constriction causes dramatic increases in systemic arterial pressure and total peripheral resistance.

- **Coronary circulation;**

Coronary circulation is the circulation of blood in the 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. Because the rest of the body, and most especially the brain, need 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 (myocardial infarctions), in which the heart muscle is damaged by oxygen starvation. Such interruptions are usually caused by ischemic heart disease (coronary artery disease) and sometimes by embolism from other causes like obstruction in blood flow through vessels.

- **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.

Some of the circulating blood volume in the skin will flow through will flow through arteriovenous anastomoses (AVAs) instead of capillaries. AVAs serve a role in temperature regulation. In this article we shall consider the different adaptations of the cutaneous circulation, and its role in body temperature control.

3) Discuss the cardiovascular adjustment that occurs during exercise;

3. Exercise probably acts at various levels in the cardiovascular system. The regulation and the integration of many cardiovascular functions are modified by exercise training. For example, exercise can improve baroreflex sensitivity, blood pressure regulation, organs perfusion and vascular reactivity. 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 autoregulatory 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 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.