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DEPARTMENT: MEDICINE AND SURGERY

COURSE: PHYSIOLOGY

1. LONG TERM REGULATION OF MEAN ARTERIAL BLOOD PRESSURE

In each cardiac cycle arterial blood pressure fluctuates between diastolic and systolic pressure. However, the body behaves from day to day as if it regulated the mean arterial blood pressure, which is the average between diastolic and systolic pressures. Such regulation is achieved by interdependent adjustments of only 3 parameters. The regulatory system includes stretch-sensitive sensors, central nervous integrators/evaluators and neuro-humoral effector mechanisms. Central nervous integration and evaluation of incoming signs mostly occurs 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 naturesis mechanisms residing in the kidney and by widespread actions of angiotensin 2. Studies have suggested that the long term controlled variable is not arterial blood pressure, but the balance between intake and output of fluid and electrolytes. If the kidney requires a higher perfusion pressure to achieve that balance then daily blood pressure regulation occurs around an appropriately higher set point.

2a. 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 pulmonary circulation loop is virtually bypassed in fetal circulation. The fetal lungs are collapsed and blood passes from the right atrium directly into the left atrium through the foramen ovale (an open conduit between the paired atria), or through the ductus arteriosus.

b. Circle of Willis: the circle of Willis encircles the stalk of the pituitary gland and provides important communications between the blood supply of the forebrain and hindbrain (that is between the internal carotid and vertebra-basilar systems following obliteration of primitive embryonic connections). Although a complete circle of Willis is present in some individuals, it is rarely seen radiographically in its entirety; anatomical variations are very common and a well-developed communication between each of its parts is identified in less than half of the population.

c. Splanchnic circulation: is composed of the blood flow originating from the celiac, superior mesenteric and inferior mesenteric arteries and is distributed to all abdominal viscera. The splanchnic circulation receives over 25% of the cardiac output and contains a similar percentage of the total blood volume under normal conditions. Thus, the splanchnic circulation can act as a site of regulation of distribution of cardiac output and also as a blood reservoir.

d. 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.

e. Cutaneous circulation: it is the circulation and blood supply of the skin. The skin is not a 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 instead of capillaries. AVAs serve a role in temperature regulation.

3.CARDIOVASCULAR ADJUSTMENT THAT OCCURS DURING EXERCISE

For the body’s cardiovascular system to adjust during the exercise, there will be an increase in the cardiac output of the heart and also redistribution of blood to areas of low demand. This causes the blood to flow

in the direction of the active skeletal muscles and also as body temperature increases so does blood supply to the skin.

During exercise, cardiac output increases to provide flow of blood needed in contracting skeletal muscles and yet by resettling the operating points for the arterial baroreceptors; vasodilations is required to make blood pressure stable and also increase during exercise.