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THE LONG TERM REGULATION OF MEAN ARTRIAL BLOOD PRESSURE

Blood Pressure can be defined as the pressure exerted or generated on the walls of the arteries as the heart forces blood into the elastic aorta. This pressure depends on the cardiac output [C.O] and the peripheral resistance [P.R]. Therefore the blood pressure can be calculated has cardiac output *peripheral resistance.

The maintenance of arterial blood pressure within a range of values is carried out by two types of responses. 1. The short term response and 2. The long term response.

Long –term arterial blood pressure control is usually concerned with the ECF and blood volume on the one hand and renal mechanisms controlling urine output on the other hand. Mean arterial blood pressure is the average between diastolic and systolic pressures. The regulation is achieved by interdependent adjustments of only 3 parameters: Heart rate (HR), ventricular stroke volume (SV) and total peripheral vascular resistance (TPVR). These are related as follows: HR - SV = Cardiac Output (CO); CO - TPVR = Mean Arterial Blood Pressure. The most important effector mechanisms are the parasympathetic and sympathetic divisions of the autonomic nervous system, the renin-angiotensin system and vasopressin. The kidney helps to maintain blood pressure by pressure diuresis, pressure natriuresis, and renin-angiotensin system.

Long-term regulation now mainly involves the regulation of extracellular fluid volume by pressure natriuresis mechanisms. It regulates blood volume increasing or decreasing the blood volume and also by the renin-angiotensin system.

Studies in hypertensive 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 will occur at an appropriately higher set point.

2.

- A. PULMONARY CIRCULATION; this is a part of the circulatory system which carries deoxygenated blood away from the right ventricle to the lungs by pulmonary artery and returns oxygenated blood to the left atrium and ventricle of the heart through the pulmonary vein. Exchange of gases occurs between blood and alveoli of the lungs at pulmonary capillaries where it gathers oxygen and leaves behind carbon dioxide and it is then sent back to the heart to be redistributed to the rest of the body. Thus, left side of the heart contains oxygenated or arterial blood and the right side of the heart contains deoxygenated or venous blood.
- B. CIRCLE OF WILLIS; The circle of Willis is a group of blood vessels in the brain that connect with each other, forming a continuous structure that resembles a circle. The nine arteries supply blood to a large portion of the brain. Mostly blood flows through the vessels of the circle of Willis without any interruption. he circle of Willis is composed of; One anterior communicating artery (ACOM),The left and right anterior cerebral arteries (ACAs),The left and right internal carotid arteries (ICAs),The left and right posterior cerebral arteries (PCAs),The left and right posterior communicating arteries (PCOMs). it is located deep in the center of the brain, near two other important structures—the pituitary gland and the optic chiasm. It's often described as being located at the base of the brain because it lies in the inferior (lower) surface of the brain. Several of the arteries of the circle of Willis branch into smaller vessels that directly provide blood to the brain, all the blood vessels there are arteries there are no veins. The ACAs provide blood to the anterior region of the brain while the PCAs provide blood to areas in the back of the brain.
- C. SPLANCHNIC CIRCULATION; the term ‘splanchnic circulation’ describes the flow of blood 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 coeliac artery; superior mesenteric artery (SMA); and inferior mesenteric artery (IMA). 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. Active constriction of veins in the splanchnic organs reduces regional blood volume. This has relatively little effect on total peripheral resistance but raises cardiac output and arterial pressure by increasing central blood volume and thus cardiac preload. A lot of extrinsic and intrinsic factors influence the splanchnic circulation. Extrinsic factors include general hemodynamic conditions of the cardiovascular system, autonomic nervous system, and circulating neurohumoral agents. Intrinsic mechanisms include special properties of the vasculature, local metabolites, intrinsic nerves, paracrine substances, and local hormones.

- D. CORONARY CIRCULATION; Coronary circulation of the heart is the circulation of blood in the blood vessels of the heart muscle (myocardium). Coronary circulation consists of coronary arteries and coronary veins. 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 semilunar 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.

- E. CUTANEOUS CIRCULATION; the cutaneous circulation is the circulation and blood supply of the skin. The skin is not a very metabolically active tissue as other tissues in the body 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 (AVAs) instead of capillaries. AVAs serve a role in temperature regulation. Vascular architecture of the skin has the general pattern of the capillary circulation. papillae contains capillary blood vessels and nerve endings. The arteries that supply the skin, originate from richly

anastomosing irregular plexus (first plexus) of the deepest part of the corium (dermis). From this cutaneous arterial plexus, the single arteriole arises and ascends through the corium and forms the second plexus just below the dermis. Capillaries arising from this plexus supply the hair follicles and papillae of the dermis. The arterioles also ascend towards the superficial layer and form the third plexus in the sub-papillary region of the dermis. Every papilla gets capillary network from this plexus.

3. THE CARDIOVASCULAR ADJUSTMENT THAT OCCURS DURING EXERCISE;

There are two types of exercise the Dynamic exercise: e.g. bicycling, swimming, etc and the Static exercise: e.g. pushing heavy objects. Exercise as various effects on the cardiovascular system. 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 and secondarily due to a reduction in end-systolic cardiac size. During moderate isotonic exercise, the systolic blood pressure increases but the diastolic blood pressure is not altered, In severe exercise involving isotonic muscular contraction, the systolic pressure enormously increases but the diastolic pressure decreases due to a decrease in peripheral resistance attributed to presence of metabolites in the working muscle. But during exercise involving isometric contraction, the peripheral resistance increases causing the diastolic pressure to increase along with systolic pressure.