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DEPARTMENT: Medicine and Surgery

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COURSE: Physiology

ASSIGNMENT

1. Discuss the long term regulation of mean arterial blood pressure.
   This involves the use of kidneys in regulating the arterial blood pressure by two ways:
   a. By regulation of ECF volume
   b. Through renin-angiotensin mechanism.
      a. Using regulation of ECF volume: when blood pressure increases, kidneys excrete large amounts of water and salt, particularly sodium, by means of pressure diuresis and pressure natriuresis and because of this, there is 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 tubule is increased. This in turn increases ECF volume, blood volume and cardiac output resulting in restoration of blood pressure.
      b. Using renin-angiotensin mechanism: when blood pressure and ECF volume decrease, renin secretion from kidneys is increased which converts angiotensinogen into angiotensin I which is converted into angiotensin II by angiotensin-converting enzyme. Angiotensin II acts in two ways to restore blood pressure;
         I. It can cause constriction of arterioles in the body so that peripheral resistance is increased and blood pressure rises.
         II. It can also stimulate the adrenal cortex to secrete aldosterone. This hormone increases reabsorption of sodium from renal tubules. Sodium reabsorption is followed by water reabsorption resulting in increased ECF volume and blood volume and blood pressure increases.
         Angiotensin III and angiotensin IV also increase blood pressure and stimulate adrenal cortex to secrete aldosterone.

2. Write short notes on the following
   a. Pulmonary circulation: it is otherwise called lesser circulation. Blood is pumped from right ventricle to lungs through pulmonary artery. Exchange of gases occurs between blood and alveoli of the lungs at pulmonary capillaries. Oxygenated blood returns to left atrium through the pulmonary veins. 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: this is the joining area of several arteries at the bottom side of the brain. At the circle of willis, the carotid arteries branch into smaller arteries that supply oxygenated blood to over 80% of the cerebrum.
   c. Splanchnic circulation: this describes the blood flow to the abdominal gastrointestinal organs including the stomach, liver, spleen, pancreas, small intestine and large intestine. It

compromises three major branches of the abdominal aorta, the coeliac artery, superior mesenteric artery and inferior mesenteric artery.

d. Coronary circulation: this is the circulation of blood in the blood vessels that supply the heart muscle. Coronary arteries supply oxygenated blood to the heart muscle and cardiac veins drain away the blood once it has been deoxygenated.
e. Cutaneous circulation: this is the circulation and blood supply of the skin. Some of the circulating blood volume in the skin will flow through arteriovenous anastomoses instead of capillaries.

3. Discuss the cardiovascular adjustment that occurs during exercise
   a. On blood: mild hypoxia developed during exercise stimulates the juxtaglomerular apparatus to secrete erythropoietin and stimulates bone marrow to release red blood cells. Increased CO_2 content in blood decreases the ph of blood
   b. On blood volume: more heat is produced during exercise and the thermos-regulatory system is activated and in turn causes secretion of large amount of sweat leading to reduced blood volume.
   c. On heart rate: heart rate increases during exercise.
   d. On cardiac output: it increases up to 20L/minute in moderate exercise and up to 35L/minute during severe exercise.
   e. On venous return: venous return remarkably increases during exercise because of muscle pump, respiratory pump and splanchnic vasoconstriction.