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COURSE: PHYSIOLOGY

DEPARTMENT: MEDICINE AND SURGERY

1. LONG-TERM REGULATION OF MEAN ARTERIAL BLOOD PRESSURE

Appropriate systemic arterial pressure is the single most important requirement for proper operation of the cardiovascular system. Without sufficient arterial pressure, the brain and the heart do not receive adequate blood flow, no matter what adjustments are made in their vascular resistance by local control mechanisms. In contrast, unnecessary demands are placed on the heart by excessive arterial pressure. Thus, although dramatic changes in peripheral resistance and cardiac function can and do occur normally during the course of our normal daily activities, mean arterial pressure is maintained within a narrow range and is tightly regulated.

Arterial pressure is continuously monitored by various sensors located within the body. Whenever arterial pressure varies from normal, multiple reflex responses are initiated, which cause the adjustments in cardiac output, and total peripheral resistance needed to return arterial pressure to its normal value. In the short term (seconds), these adjustments are brought about by changes in the activity of the autonomic nerves leading to the heart and peripheral vessels. In the long term (minutes to days), other mechanisms such as changes in cardiac output brought about by changes in blood volume play an increasingly important role.

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- A. 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.

CLINICAL IMPORTANCE

A number of medical conditions can affect the pulmonary circulation.

- Pulmonary hypertension describes an increase in resistance in the pulmonary arteries
- Pulmonary embolus is a blood clot, usually from a deep vein thrombosis that has lodged in the pulmonary vasculature. It can cause difficulty breathing or chest pain, is usually diagnosed through a CT pulmonary angiography or V/Q scan, and is often treated with anticoagulants such as heparin and warfarin.

- Cardiac shunt is an unnatural connection between parts of the heart that leads to blood flow that bypasses the lungs.
 - Vascular resistance
 - Pulmonary shunt
- B. CIRCLE OF WILLIS: The circle of Willis (also called Willis' circle, loop of Willis, cerebral arterial circle, and Willis polygon) is a circulatory anastomosis that supplies blood to the brain and surrounding structures. It is named after Thomas Willis (1621–1675), an English physician.

FUNCTION

The arrangement of the brain's arteries into the circle of Willis creates redundancy (analogous to engineered redundancy) for collateral circulation in the cerebral circulation. If one part of the circle becomes blocked or narrowed (stenosed) or one of the arteries supplying the circle is blocked or narrowed, blood flow from the other blood vessels can often preserve the cerebral perfusion well enough to avoid the symptoms of ischemia.

- C. SPLANCHIC CIRCULATION: The term 'splanchnic circulation' describes the blood flow 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.
- D. CORONARY CIRCULATION: Coronary circulation 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. Because the rest of the body, and most especially the brain, needs 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, in which the heart muscle is damaged by oxygen starvation. Such interruptions are usually caused by ischemic heart disease and sometimes by embolism from other causes like obstruction in blood flow through vessels.

- E. CUTEANEOUS 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. CARDIOVASCULAR ADJUSTMENT THAT OCCUR DURING EXERCISE

Cardiovascular Adaptations to Exercise. Stroke Volume (SV) The increase in size of the heart enables the left ventricle to stretch more and thus fill with more blood. The increase in muscle wall thickness also increases the contractility resulting in increased stroke volume at rest and during exercise, increasing blood supply to the body.