

Eleventh Lecture

11. Cardiovascular system

Summary of previous lectures

In the previous lectures we talked about the basic elements of the medical word: word root, combining form, suffix, and prefix. The meaning of a word is determined by how these elements are combined. Detailed information about suffixes is mentioned. Suffix linking and suffix types are explained in detail and many examples related to the surgical, diagnostic, pathological, grammatical and plural suffixes are also provided. Detailed information about prefixes is also mentioned. Prefix linking and prefix types are explained in detail and many examples related to different types of prefixes are provided.

The basic structural and functional organization of the body from the cellular level to the organism level is also presented. Additionally, terms used to describe planes of the body, body cavities, quadrants and regions of the abdominal cavity, and divisions of the spinal column are presented. These terms are considered as an essential part of medical terminology and are used in all body systems. We moved on to talk about the body systems in detail.

Starting with the digestive system, also called the gastrointestinal (GI) system, it is mentioned that it consists of a digestive tube called the GI tract or alimentary canal, and several accessory organs whose primary function is to break down food, prepare it for absorption, and eliminate waste. The GI tract, extending from the mouth to the anus, varies in size and structure in several distinct regions. Many terms related to the digestive system are also introduced.

Next, we talked about the respiratory system and how it is responsible for the exchange of oxygen (O₂) and carbon dioxide (CO₂). Oxygen is carried to all cells of the body in exchange for CO₂, a waste product. The cardiovascular system helps in this vital function by providing blood vessels for carrying these gases. Failure or deficiency in either system has the same effect on the body: disturbance of

homeostasis and O₂ starvation in tissues that may cause death. The respiration process and some medical word elements related to the respiratory system are also introduced.

11.1. Anatomy and Physiology²¹¹

The cardiovascular (CV) system is composed of the heart and blood vessels. The heart is a hollow, muscular organ lying in the mediastinum, the centre of the thoracic cavity between the lungs. The pumping action of the heart propels blood containing oxygen, nutrients, and other vital products from the heart to body cells through a vast network of blood vessels called arteries. Arteries branch into smaller vessels until they become microscopic vessels called capillaries. It is at the capillary level that exchange of products occurs between body cells and blood. Capillaries merge to form larger blood vessels called venules, which then combine to form veins, the vessels that return blood to the heart to begin the cycle again. Millions of body cells rely on the cardiovascular system for their survival. When this transportation system fails, life at the cellular level is not possible and, ultimately, the organism will die.

11.1.1. Anatomy and Physiology Key Terms

This section introduces important terms and their definitions and pronunciation.

Term	Pronunciation ²¹²	Arabic ²¹³	Meaning
autonomic nervous system (ANS)	,ɔ:tənɒmɪk 'nɜ:vəs sɪstəm	الجهازُ العَصَبِيُّ المُسْتَقِلُّ	Portion of the nervous system that regulates involuntary actions, such as heart rate, digestion, and peristalsis ²¹⁴
leaflet	'li:flət	وَرِيْقَة	Thin, flattened structure; term used to describe the leaf-shaped structures that compose a heart valve
lumen	lumen	لَمْعَة؛ لَمْعَة	Tubular space or channel within any organ or structure of the body; space within an artery, vein, intestine, or tube
regurgitation	rɪˌgɜ:dʒɪ'teɪʃn	قَلَس	Backflow or ejecting of contents through an opening

²¹¹ Medical Terminology Systems - A Body Systems Approach: Cardiovascular System - Anatomy and Physiology p. 186

²¹² Oxford Advanced Learner's Dictionary, 8th ed. or: <http://dictionary.reference.com/>

²¹³ <http://www.emro.who.int/Unified-Medical-Dictionary.html>

²¹⁴ Peristalsis: /,peri'stælsɪs/ the wave-like movements of the intestine caused when the muscles contract and relax

sphincter	'sfɪŋktə(r)	مَصْرَعة	Circular muscle found in a tubular structure or hollow organ that constricts or dilates to regulate passage of substances through its opening
vasoconstriction	ˌveɪzəʊkən'strɪkʃn	تَضْيِيقُ الأوعِيَةِ	Narrowing of the lumen of a blood vessel that limits blood flow, usually as a result of diseases, medications, or physiological processes
vasodilation	ˌveɪzəʊdaɪ'leɪʃn	تَوْسِيعُ الأوعِيَةِ	Widening of the lumen of a blood vessel caused by the relaxing of the muscles of the vascular walls
viscosity	vɪ'skɒsəti	لزوجة	State of being sticky or gummy A solution that has high viscosity is relatively thick and flows slowly.

11.1.2. Vascular System

Three major types of vessels - (1) artery, (2) capillary, and (3) vein - carry blood throughout the body. (See [Figure 11-1](#)) Each type of vessel differs in structure depending on its function.

11.1.2.1. Arteries

Arteries carry blood from the heart to all cells of the body. Because blood is propelled through the arteries by the pumping action of the heart, the walls of the arteries must be strong and flexible enough to withstand the surge of blood that results from each contraction of the heart.

The walls of large arteries have three layers to provide toughness and elasticity. The (4) tunica²¹⁵ externa is the outer coat composed of connective tissue that provides strength and flexibility. The (5) tunica media is the middle layer composed of smooth muscle. Depending on the needs of the body, this muscle can alter the size of the (7) lumen of the vessel. When it contracts, it causes vasoconstriction, resulting in decreased blood flow. When it relaxes, it causes vasodilation, resulting in increased blood flow. The (6) tunica intima is the thin, inner lining of the lumen of the vessel, composed of endothelial²¹⁶ cells that provide a smooth surface on the inside of the vessel.

²¹⁵ Tunica: /'tju:nɪkə/

²¹⁶ Endothelium: /,endəʊ'θi:lɪəm/ (pl. -lia /-lɪə/) a tissue consisting of a single layer of cells that lines the blood and lymph vessels, heart, and some other cavities

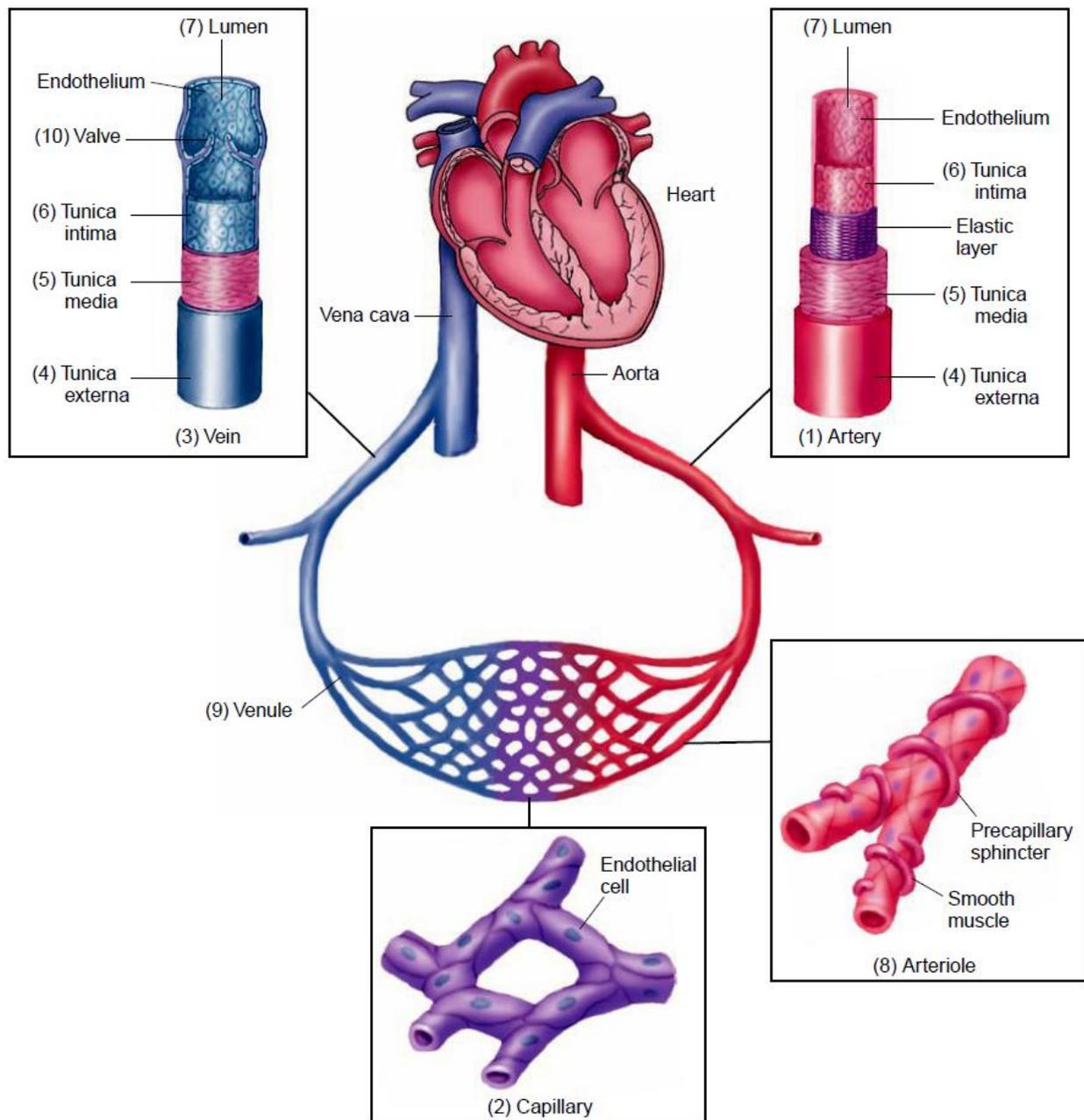


Figure 11-1: Vascular structures

The surge of blood felt in the arteries when blood is pumped from the heart is referred to as a pulse. Because of the pressure against arterial walls associated with the pumping action of the heart, a cut or severed artery may lead to profuse²¹⁷ bleeding.

²¹⁷ Profuse: /prə'fju:s/ produced in large amounts

Arterial blood (except for that found in the pulmonary artery) contains a high concentration of oxygen (oxygenated) and appears bright red in colour. Oxygenated blood travels to smaller arteries called (8) arterioles and, finally, to the smallest vessels, the capillaries.

11.1.2.2. Capillaries

Capillaries are microscopic vessels that join the arterial system with the venous system. Although they seem like the most insignificant of the three vessel types owing to their microscopic size, they are actually the most important because of their function. Because capillary walls are composed of only a single layer of endothelial cells, they are very thin. This thinness enables the exchange of water, respiratory gases, macromolecules, metabolites, and wastes between the blood and adjacent cells. The vast number of capillaries branching from arterioles causes blood to flow very slowly, providing sufficient time for exchange of necessary substances.

Blood flow through the highly branched capillary system is partially regulated by the contraction of smooth muscle precapillary sphincters that lead into the capillary bed. When tissues require more blood, these sphincters open; when less blood is required, they close. Once the exchange of products is complete, blood enters the venous system for its return cycle to the heart.

11.1.2.3. Veins

Veins return blood to the heart. They are formed from smaller vessels called (9) venules that develop from the union of capillaries. Because the extensive network of capillaries absorbs the propelling pressure exerted by the heart, veins use other methods to return blood to the heart, including:

- skeletal muscle contraction
- gravity
- respiratory activity
- valves.

The (10) valves are small structures within veins that prevent the backflow of blood. Valves are found mainly in the extremities and are especially important for returning blood from the legs to the heart because blood must travel a long distance against the force of gravity to reach the heart from the legs. Large veins, especially in the abdomen, contain smooth muscle that propels blood toward the heart by peristalsis.

Blood carried in veins (except for the blood in the pulmonary veins) contains a low concentration of oxygen (deoxygenated) with a corresponding high concentration of carbon dioxide. Deoxygenated blood takes on a characteristic purple colour. Blood continuously circulates from the heart to the lungs so that carbon dioxide can be exchanged for oxygen.