# Chapter 4

## Blood vessels and lymphatic vessels histology

### 4.1 Blood vessels

Blood vessels consist of tubes of varying sizes that form a circuit, facilitating the transport of blood from the heart to the body's tissues and returning it to the heart. This circulatory system is responsible for distributing oxygen obtained from the lungs, nutrients sourced from the intestines and liver, as well as regulatory substances like hormones to all organs and tissues. Additionally, waste products are introduced into the circulation and transported to organs such as the lungs and kidneys for removal.

Blood vessels are composed of three concentric layers: tunica intima, tunica media, and tunica adventitia

• The **tunica intima** is composed of a continuous sheet of simple squamous endothelial cells lining the lumen and of various amounts of subendothelial connective tissue.

• The **tunica media**, usually the thickest of the three layers in the arterial leg of the circulatory system, is

composed of circularly arranged smooth muscle cells and fi broelastic connective tissue, whose elastic content increases greatly with the size of the vessel.

• The **tunica adventitia** is the outermost layer of the vessel wall, consisting of fi broelastic connective tissue. In larger vessels, the tunica adventitia houses **vasavasorum**, small blood vessels that supply the tunica adventitia and media of that vessel. In the venous leg of the circulatory system, it is the tunica adventitia that is the thickest of the three layers.

### 4.2. Arterial system

The arterial system is responsible for transporting blood from the heart to capillary networks throughout the body. The heart's rhythmic contractions create a pulsatile flow of blood within the arteries. During the contraction phase of the ventricles (systole), blood is forcefully pushed into the arteries, leading to the expansion of their walls. The subsequent elastic recoil of these walls during the relaxation phase (diastole) plays a crucial role in sustaining blood pressure between heartbeats. This pulsatile nature is attributed to the elastic fibers present in the arterial walls.

Blood distribution to various organs and tissues is managed by adjusting the diameter of the distributing vessels, a process regulated by the circular smooth muscle found in the vessel walls. This regulation is primarily influenced by the sympathetic nervous system and hormones from the adrenal medulla.

Arteries, like all blood vessels, possess a three-layered structure but are characterized by a high concentration of elastin and a relatively thick layer of smooth muscle compared to their lumen size. The arterial system comprises three principal types of vessels:

- **Elastic arteries**– These are large vessels, including the aorta, brachiocephalic trunk, common carotid, subclavian, and major pulmonary arteries, which help to mitigate the pressure variations resulting from cardiac output.

- **Muscular arteries** – These medium-sized arteries, such as the radial, femoral, coronary, and cerebral arteries, are responsible for directing blood flow to specific areas.

- **Arterioles** – These are the smallest branches of the arterial network that control blood flow into the capillary beds.

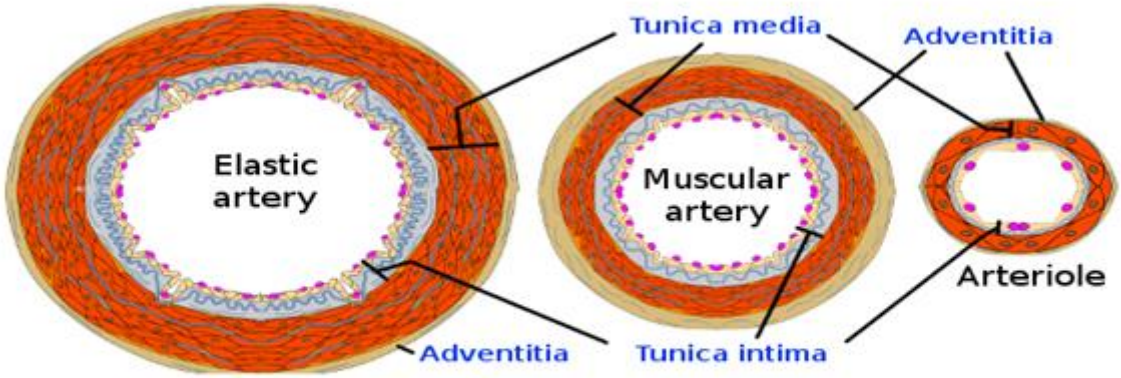


Figure.28. Organisation of the tunica in the arteries

### 4.2.1. Elastic arteries

Elastic arteries are composed of tunica intima, tunica media, and the tunica adventitia. The tunica intima is made up of a single layer of flattened endothelial cells that rests on a supportive layer of collagenous tissue rich in elastin, arranged as both fibres and discontinuous sheets. The tunica media is notably wide and highly elastic. At higher magnification in micrograph, it is revealed to consist of concentric fenestrated sheets of elastin, interspersed with collagenous tissue and smooth muscle fibers. As seen in micrograph (a), the collagenous tunica adventitia contains small vasa vasorum V, which also extend into the outer half of the tunica media.

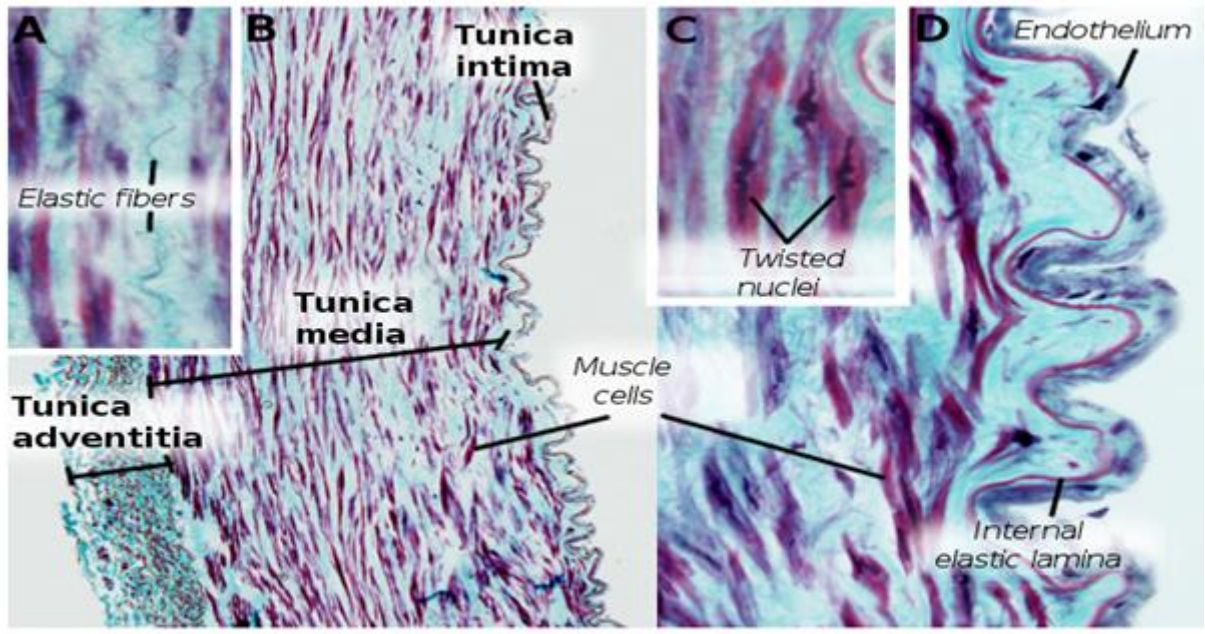


Figure.29. Elastic artery

### 4.2.2. Muscular arteries

In muscular arteries, elastic tissue is primarily organized into two distinct elastic layers. The first layer, known as the internal elastic lamina (IEL), is situated between the tunica intima and the tunica media. The second layer, the external elastic lamina (EEL), is less prominent and varies in appearance, located between the tunica media and the adventitia. The tunica intima is typically a very thin layer that is not discernible at low magnification, while the tunica media consists of smooth muscle fibers arranged concentrically, interspersed with sparse elastic fibers. The tunica adventitia varies in thickness and is made up of collagen along with a varying amount of elastic tissue; in larger muscular arteries, this layer may also feature prominent vasa vasorum., elastic tissue is primarily organized into two distinct elastic layers. The first layer, known as the internal elastic lamina (IEL), is situated between the tunica intima and the tunica media. The second layer, the external elastic lamina (EEL), is less prominent and varies in appearance, located between the tunica media and the adventitia. The tunica intima is typically a very thin layer that is not discernible at low magnification, while the tunica media consists of smooth muscle fibers arranged concentrically, interspersed with sparse elastic fibers. The tunica adventitia varies in thickness and is made up of collagen along with a varying amount of elastic tissue; in larger muscular arteries, this layer may also feature prominent vasa vasorum.

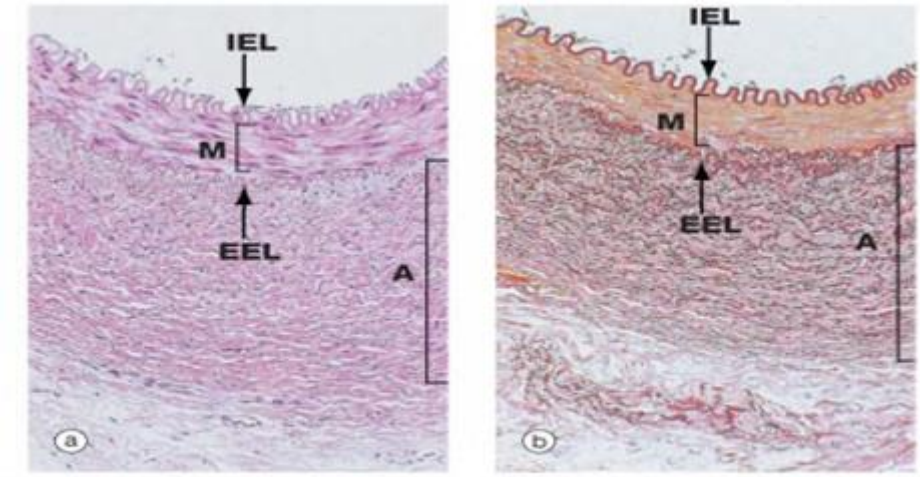


Figure.30. Muscular artery

### 4.2.3. Arterioles

In arterioles, the thin lintima is lined with endothelial cells E and the media M is composed of only 2 to 3 muscle layers. The adventitia is thin and fuses imperceptibly with the surrounding collagenous fibrous tissue.

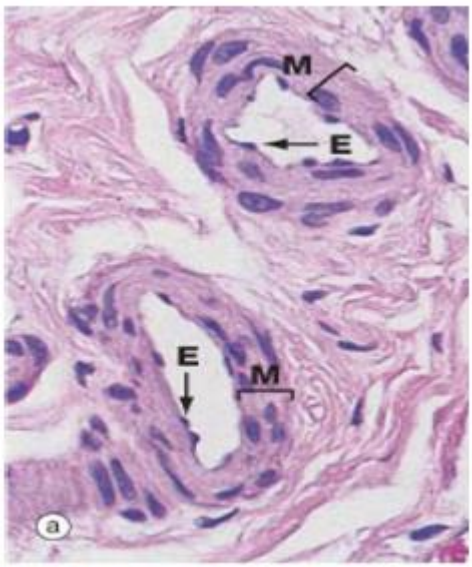


Figure.31. Arteriol histology

## 4.3. Lymphatic vessels

Lymphatic vessels may appear either collapsed and thus histologically inconspicuous, or distended with lymph, rendering them more easily identifiable. In sections where they are distended, lymphatic vessels present as clear, endothelium-lined channels that can be mistaken for venules due to their thin walls and similar morphology. However, a distinguishing feature is the absence of erythrocytes within their lumina, which instead may contain lymphocytes or

other immune cells. The endothelial lining is typically composed of a single layer of flattened endothelial cells and frequently exhibits bicuspid valves, oriented in the direction of lymph flow, which function to prevent backflow. These valves are more prominent in medium- to large-caliber lymphatic vessels and contribute to unidirectional lymph transport, a process facilitated by skeletal muscle contraction and vessel wall.