ANAT 2160/BIOL 3430 Blood Vessels Laboratory Module

Objectives

1) Define the characteristics of the walls of blood vessels in different regions of the circulatory system, and understand the relationship of wall structure to internal pressure in these vessels.
2) Use these characteristics to identify blood vessels of all types in body tissues.

Overview

The blood vessels in the circulatory system are hollow tubes through which blood flows. The pressure of the blood in these tubes differs in each region of the circulation, so the histological structure of the wall varies. Blood pressure is highest in the arteries, distributing blood to all vascular beds in the body, and falls in the capillaries to a pressure near that of extracellular tissue fluid. Blood is collected from the capillaries in venules which drain into a series of larger and larger veins and finally returns to the heart, but pressure remains low in the veins. Blood vessel walls are thickest in the large arteries where pressure is highest and wall thickness decreases as blood pressure decreases in smaller arterial branches. The capillary wall is the thinnest of all blood vessels so that the diffusion distance is a short as possible to facilitate exchange of gases, nutrients and wastes with the tissues. The walls of veins, even when their diameter is large, are always much thinner than those of arteries of the same lumen diameter, since venous blood pressure is much lower than arterial pressure. As you analyze the slides listed below, keep this general principle in mind to make sense of changes in wall structure throughout the circulation.

62, aorta, muscular artery and vein; 88, segment of aorta. A cross-section of a whole aorta from a rat is on slide 62 (as well as some smaller vessels, see below), while a segment of human aorta, stained specifically to demonstrate elastin, is on slide 88. On slide 62 the nuclei of the simple squamous endothelial cells show up as small bumps on the lumenal surface of the tissue. There is a subendothelium, but because of the prominence of dark-staining elastic laminae in this tissue the subendothelium is obscured. The inner elastic lamina is the innermost layer of elastin, and multiple elastic laminae fill the whole tunica media. Between the elastic laminae are poorly stained nuclei of smooth muscle cells (responsible for making and maintaining the extracellular matrix), collagen Type I fibres and single elastin fibres. The outer elastic lamina is the outermost complete layer of elastin, marking the border between the tunica media and the tunica adventitia. The tunica adventitia, composed mostly of loose connective tissue with a few elastin fibres, will also have some small blood vessels that supply oxygen and nutrients to the tunica media (these vessels are called the vasum vasorum). The tissue on slide 88 has been specifically stained to show up elastin in the elastic laminae; the subendothelium can be seen clearly in this slide.

207, splenic artery and vein; 62, muscular artery and vein. These slides show arteries and veins of different internal diameters. The splenic artery, a large muscular artery on slide 207, has a prominent internal elastic lamina and multiple elastic fibres in the subendothelium as well as an obvious external elastic lamina and a thick tunica media.

The connective tissue of the tunica adventitia blends into the surrounding tissue without a clear border. The artery shown on slide 62 is smaller than that on slide 207 but also has prominent internal and external elastic laminae and multiple elastic fibres in the tunica adventitia, as well as a well-defined tunica media. The vein on this slide may be collapsed so that its lumen is folded or distorted. Compare the structure and wall thickness of this vein and the one on slide 207 with the arteries shown on these slides. The internal and external elastic laminae will be present in veins but may be incomplete.

54, 105, thymus. The thymus has an extensive vasculature, and in these slides many blood vessels ranging from muscular arteries to arterioles to venules and veins can be seen in the connective tissue between thymic lobules containing lymphocytes. You should be able to identify all of these vessel types on these slides.

4, esophagus. This slide is excellent for identifying small blood vessels. Look under the epithelium in the loose connective tissue of the lamina propria to identify capillaries, venules, arterioles and lymphatic vessels. Lymphatic vessels have irregular and partly collapsed lumens, simple squamous endothelium and no erythrocytes in the lumen.