Fisrt Histology lab
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Histology of CVS:
CVS component are heart and blood vessels.
Heart is located inferior and medium of mediastinum.
Heart has three layer: endocardium, myocardium (composed of cardiac muscle), epicardium (visceral layer of epicardium).
*heart mainly is composed of cardiac muscle that is: striated, branched, has a central nuclei with 1-2 nuclei within a cardiac cell and has a intercalated disk. Intercalated disks are Gap junction, which function is to make the heart work as one unit (syncytium character of the heart), and if propagation of action potential happen, the action potential will transmit through this type of junction.

Now we will talk about blood vessel, note that three previous layer of the heart (endo-, myo-, epi-) match with three layer of blood vessel (intima, media, adventitia).
Layers of blood vessels:
1- innermost is tunica intima which is a single layer endothelial cell with a small amount of subendothelial CT that support it. It lines blood vessels.

2- tunica media: It's a smooth muscle layer mainly has collagen type 3 (i.e.: reticular fiber), also has elastic fiber, proteoglycan and glycoprotein.
The intima is separated from the media by a dense elastic membrane called the internal elastic lamina (IEL).

3- tunica adventitia: layer of CT has mainly fibers of collagen type 1 and some elastic fiber.

The media is separated from the adventitia by a dense elastic membrane called the external elastic lamina (EEL).

Note: large vessels have vasa vasorum in outer aspect of media and adventitia. We said in outer aspect of media and adventitia because large arteries are very thick that blood supply in lumen can supply only intima and inner aspect of media by its diffusion, but it doesn't reach outer aspect of media and adventitia so they vasa vasorum (blood
vessels of blood vessels) in order to feed them.

These previous layer are found in all blood vessels except in capillaries, which is a 1-2 layer of endothelial cell based upon basal lamina. The diameter of capillary is about 7-9 micrometer.

Types of artery:
a-elastic artery: (elastic fiber of adventitia), although it's name is elastic artery but it also has other components, but we say mostly it contain elastic artery. Cross section is not shown because it's too large reach 1 inch in diameter (2.5 cm), so you may not see lumen.

found in aorta and pulmonary trunk.
usually elastic fiber can not be seen in H&E stain. so special stain is used to see elastic fiber in a blue stain.
You may notice that the elastic fiber and smooth muscle cell are arranged according to the site of nucleus in the first photo and the site of collagen fiber in the second one. Elasticity is need to stand with blood pressure / ability to receive blood from ventricle and re-push the blood to other artery.

b-muscular artery: dominant smooth muscle cell in tunica media, abundant nuclei, internal elastic lamina is not
shown while external elastic lamina is shown. ex: femoral artery.

c- arterioles have very thin adventitia, thin tunica intima and 2 layers of tunica media. It's diameter is less than 0.5mm. Internal and external elastic lamina aren't shown.

difference between vein and artery is that vein has wide lumen and larger tunica adventitia layer but less media layer, while artery has larger tunica media and less adventitia.
Valves may be shown in veins to allow unidirectional flow and prevent blood return back. Valves are folding from tunica intima and may be seen in lymphatic vessel, but in lymphatic vessels there's no RBC's in lumen.
they are similar to semilunar valve but instead have two leaflet rather than three.

Capillay:

1-continuous capillary: endothelial cell continuous and basal lamina continuous "complete basal lamina", found in brain (nervous tissue), skin, exocrine gland
and CT.
It’s function in transfer of O2 & CO2.
2-fenestrated (in kidney and intestine).
basal lamina is complete but pore is shown in endothelial lamina.
It's function in transfer ion (ca++, k+, Na+)
3- discontinuous (sinusoid):
has apore within basal lamina, found in liver, spleen, and bone marrow, it produces large molecule (i.e: macrophage, blood cell, and protein).
Cardiac muscle cell " in H& E " stain .

HOW TO DISTINGUISH?
- branching is clear
- intercalated disk
- central nucleus but here appeared peripheral related to sectioning
- striation

Cell border is from one intercalated disk to another the striation is related to presence and arrangement of actin and myocin

Picture 2: in this section of tissue , neurovascular bundle shown ( artery+vein+ neuron ) .
In upper bundle , the circular piece is the arteriole almost 4 layer " seen by their nuleus " .
the oval shape is venule, the ratio between lumen and wall is larger than artery for the same size blood vessel. collapsed venule is related to have a thin muscular layer.

in normal condition (in live cell) where the adventitia connect the venule to the surrounding tissue there's no collapse, but as a result of cut section we found it collapsed and because we do not have elastic fiber, it can not return to normal condition "not collapsed"
In low part of this picture, this elongated vessel is artery and not vein but artery collapsed. We considered it a vein despite that its media is thick. In fact, we considered it a vein because of the smooth muscle bundle. However, its media is thick, so it is considered a vein.

Medium artery also called distributing artery and elastic artery called conducting artery.

**Note:** There's another structure on the level of small vessel size and capillary called perisites, which form a net that has the same function of tunica media. It's considered an alternative of smooth muscle, but it's spiral or helical shaped and its nucleus is oval.
Elastic artery:
Intima is located in the lower part of photo, we can see RBC'S and loose CT. the endothelial is one layer of simple squamous epithelial and it's nuleus facing the lumen on one edge. Many elastic fiber in tunica media.

to name it as elastic artery we should see more than 50 layer of elastic fiber as we have here.it's well arranged elastic fiber
to receive blood from ventricle wall of aorta.

*note: in the wall of aorta semilunar we have an open into the coronary artery, these type of artery can not handle the pressure of ventricle so there open exist in mitral valve and it's open after the blood leave from aorta.

*note: histologist tend to teach aslide for ammalian artery rather than human artery (one reson is that human artery is so large to be prepared on slide and it's diffecult to have human organs to prepare it) the following two picture are aorta, while the first one represent true human aorta the seconed one represent mammalian aorta.
please contact us if you have any note
Good luck