CVS HISTOLOGY LAB

THE VESSELS

AORTA – H&E STAIN (GENERAL STAIN)

- H&E is used here and its general stain, not a specific stain. Otherwise, we have other specific stains (e.g. ones that are specific for collagen or elastin fibers or even MORE specific which is immunohistochemistry).

- Aorta has 3 main layers, most outer is adventitia, followed by the middle layer which is called media and the inner-most layer which is called the intima (**smooth** SQ epithelium **lining** the inside of the aorta)

- How do you distinguish the adventitia from the intima (lumen)? The intima is smooth lining not loose and irregular like seen on the most outer layer (adventitia). (check **the next slide** to see what we mean)

The most outer layer **VS** the inner most layer

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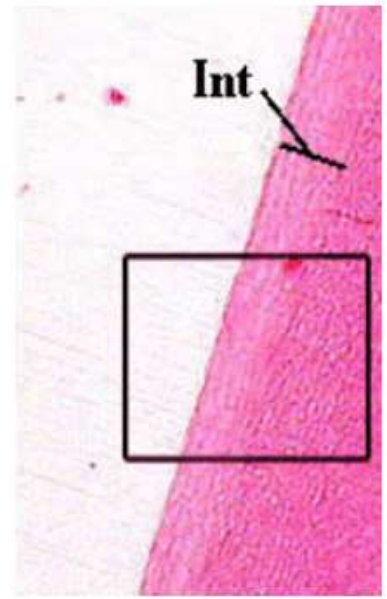
VS



The intima of the aorta

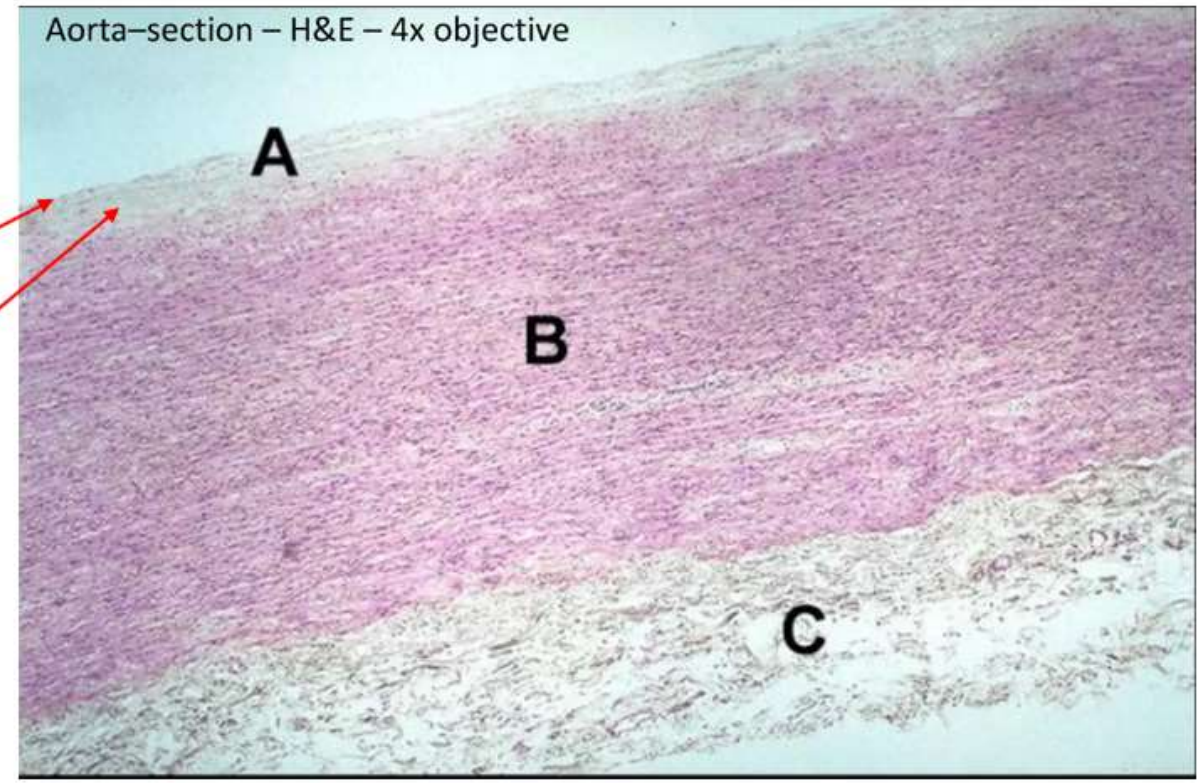
- How does the SQC (**s**imple s**q**uamous epithelium **c**ell) appear under the microscope? It's a flat cell (line) and has a nucleus.

  The flattened cells are easily damaged during preparation, and it may be difficult to identify the endothelium.

- The **subendothelial layer** (mainly loose CT and collagen) is directly found under the **endothelium** (SQC).

- **Internal elastic lamina** is indistinct compared to the muscular arteries.

- Notice the smooth inner lining of the aorta here and the subendothelial beneath it.



A = tunica intima (interna) B = tunica media C = tunica adventitia (externa)

What's the difference between an artery and a vein?

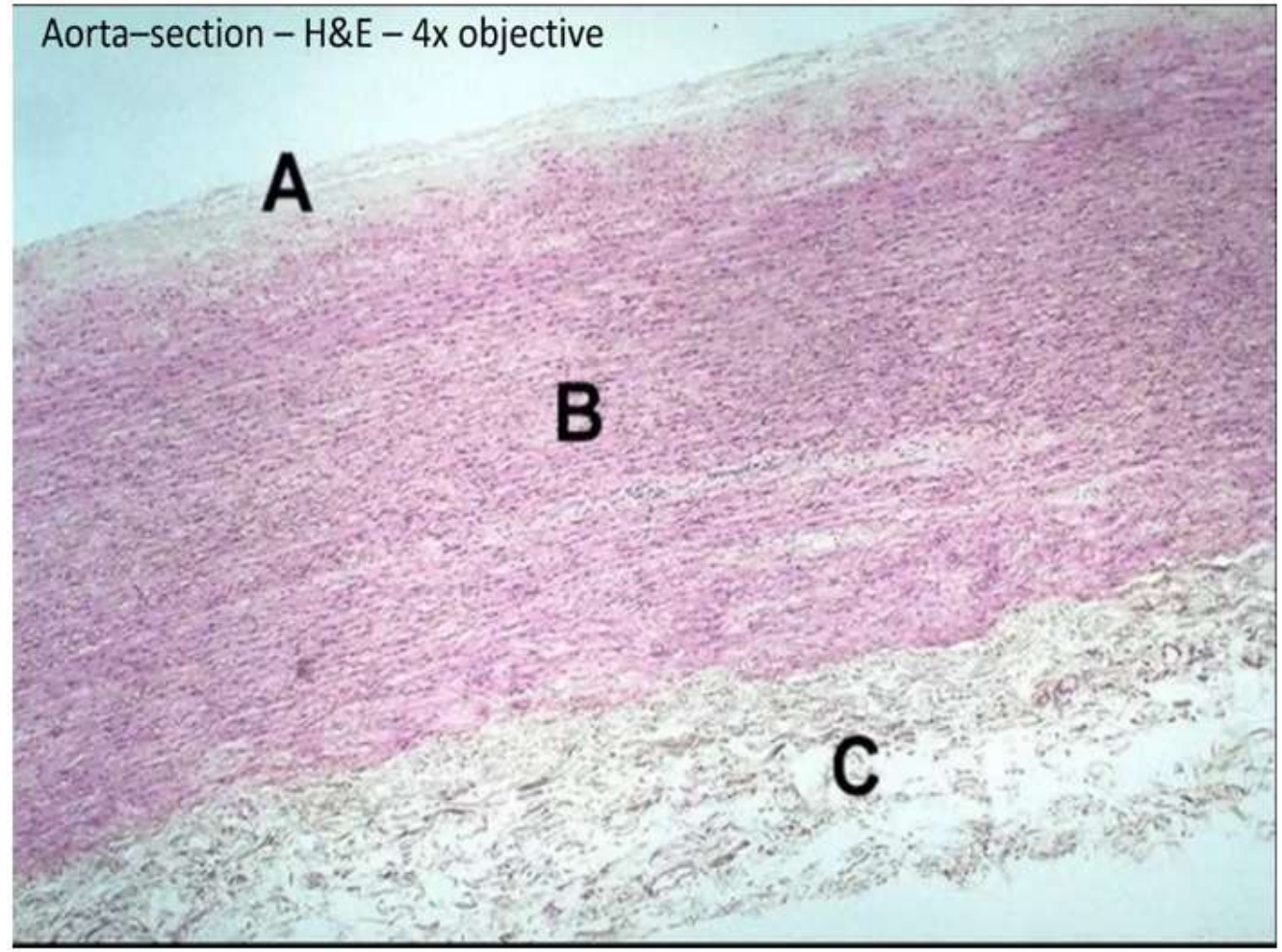
- The **internal and external elastic laminae** are ONLY found within the arteries (**elastic, muscular and arterioles**) not the veins.

- **Tunica media and tunica adventitia ratio** is **DIFFERENT** between the arteries and the veins. IN THE VEINS, the adventitia **to** the media ratio is **GREATER** than in the ARTRIES. While in the ARTRIES, the media **to** the adventitia ratio is **GREATER** than in the VEINS.

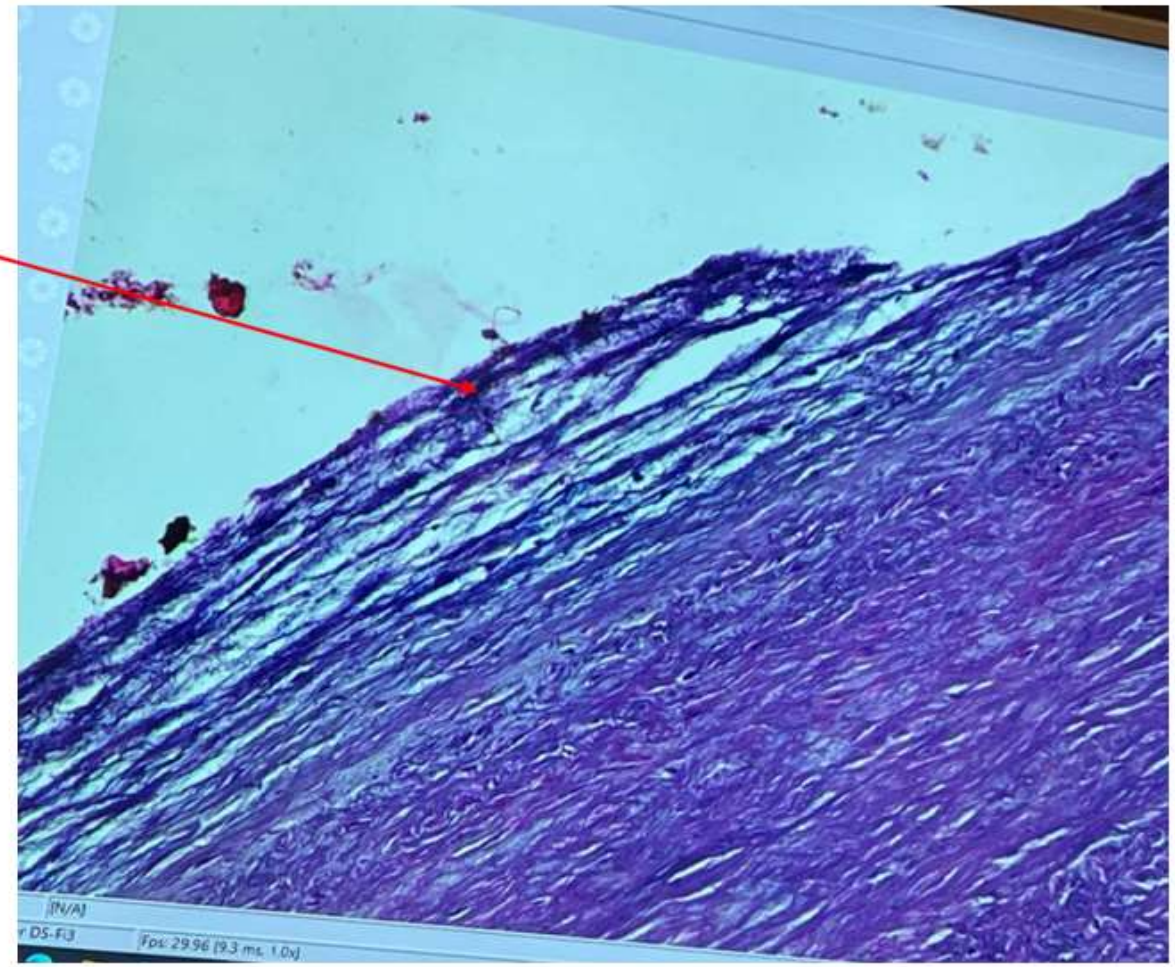
- Under the H&E, we can see the ratio difference easily.

- Look at this aorta section, the **B** (media) and the **C** (adventitia) are diff. in ratio.

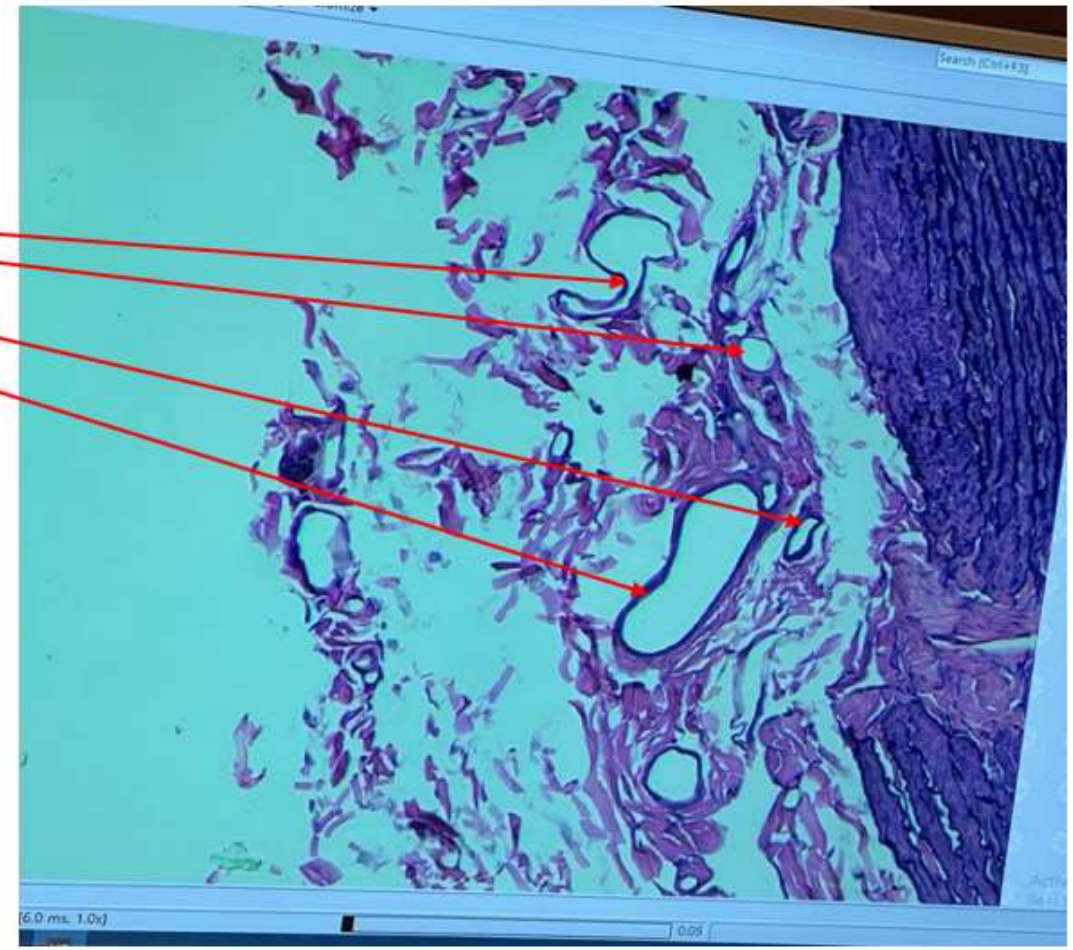
- The adventitia seen here is LOOSE, mainly loose CT and blood vessels **(**vasa vasorum –not seen in this section-**)**.



- Look at the intima here.



- Look at the adventitia here, the **vaso vasorum** is seen in this section.



What's the difference between the different arteries?

❑ THE ELASTIC TO SMC'S RATIO:

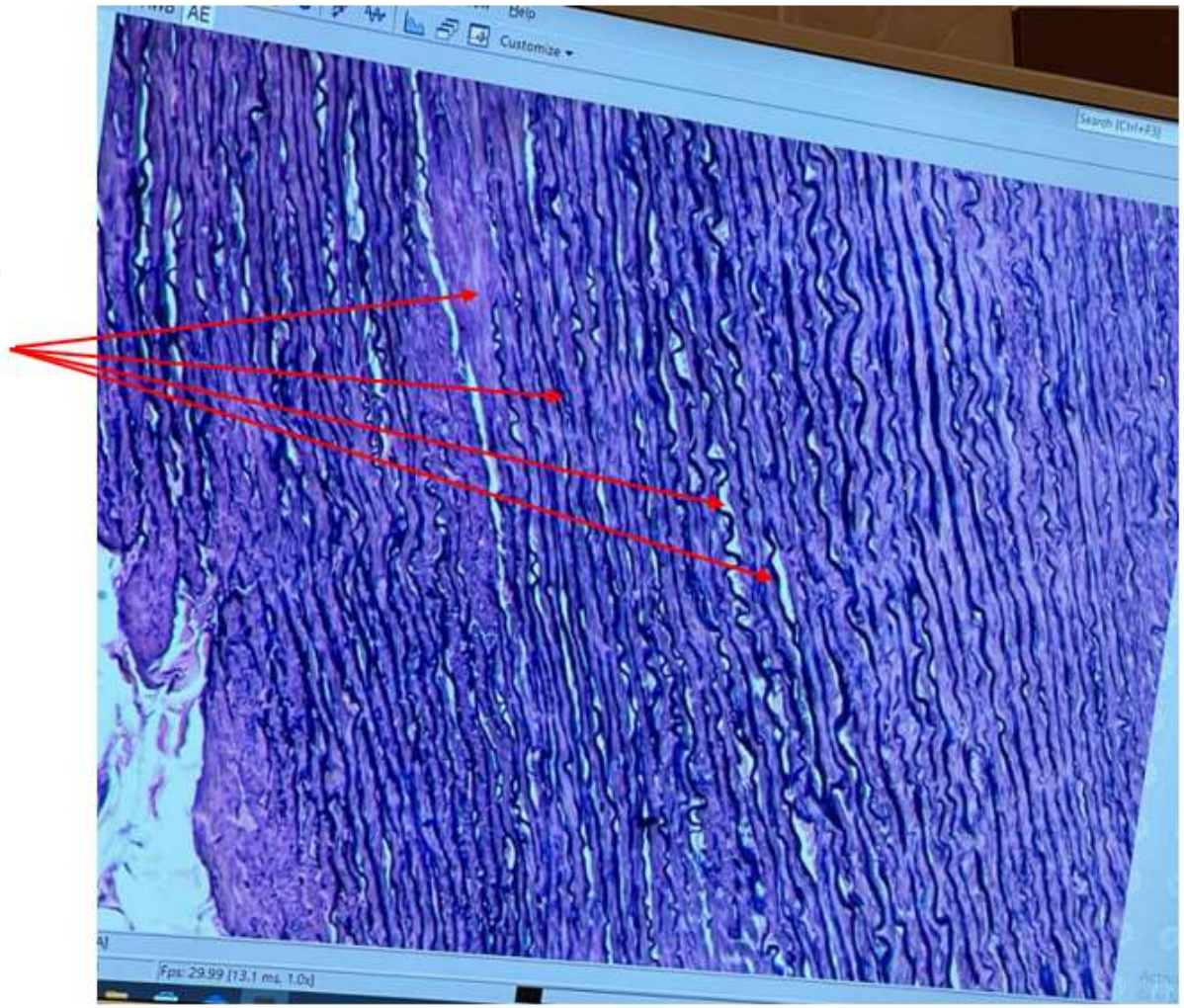
- The elastic artery (also known as conducting artery or large artery) is **full of elastic fibers** (elastic lamellae arrangement, eccentric circles all around the vessels) found in the **tunica media mainly** and they may obscure the internal & external elastic lamina.

- The **RATIO** of elastic fibers to smooth muscles in the large arteries is **GREATER** than that in medium and smaller arteries.

- In the large arteries, the layers in general are **way more nemours** than in medium and smaller arteries.

- Look at the tunica media here, the elastic lamellae arrangement, eccentric circles all around the vessels is seen in this section.

- These lamellae can be found under the H&E but not as clear as it's shown under this specific stain here. (ما تعتمد على انك تدور الطبقات الموجية لانو مو دائما بتلاقيها)



What's the difference between the different arteries?

❑ THE NUMBERS OF LAYERS IN THE TUNICA MEDIA:

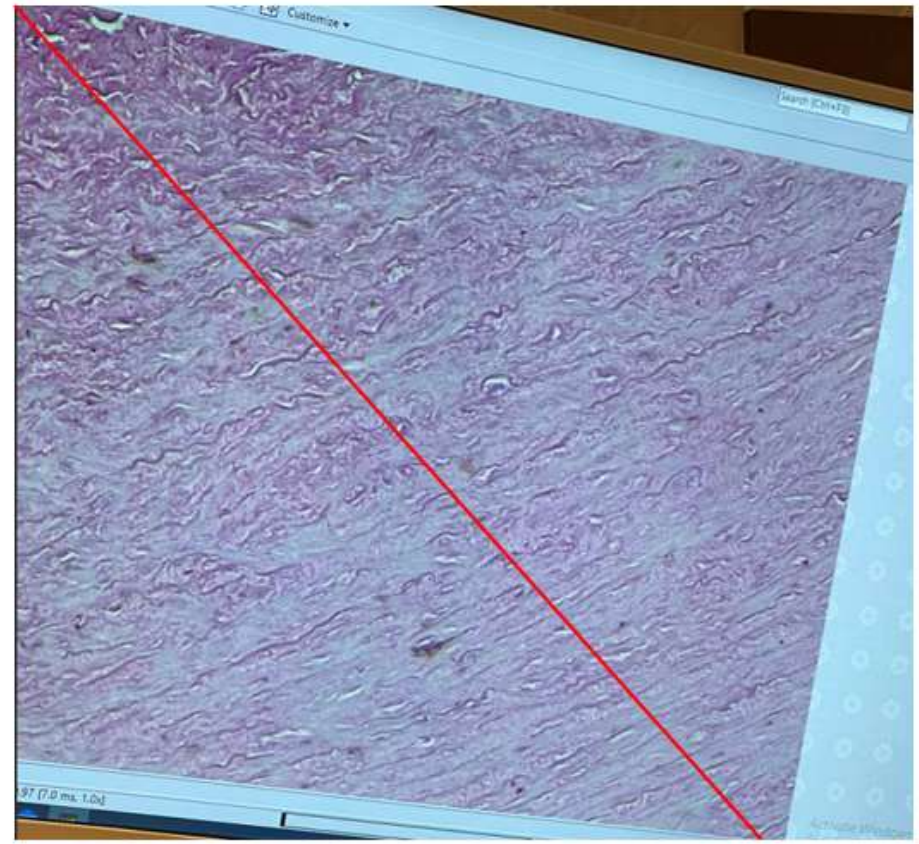
- 5-6 or 7 maximum layers in the tunica media are found **within arterioles (small arteries).**
- Up to 20+ layers in the tunica media are found **within medium size arteries (muscular arteries).** More than that are then called **large arteries (elastic arteries).**

How to tell the difference between the **large** and the **medium** artery under **H&E stain**?

- Without a specific stain, **we still can** tell the difference between elastic fibers and smooth muscle cells. HOW?!

- Smooth muscle cells (SMCs) are cellular structures, while elastic fibers are fibrous components devoid of nuclei. Consequently, as the content of elastic fibers increases, there will logically be fewer SMCs **(**the **ratio** of smooth muscle cells (SMCs) or nuclei to elastic fibers is **LOWER**), resulting in less nuclei visible to see in the tunica media. (you may see some nuclei of some separated fibroblasts or some few SMC'S).

- **5-10** micrometer is the approximately avg. **cell size** and also the **elastic fibers**, while the **nucleus size** is close to **3-4** micrometer.

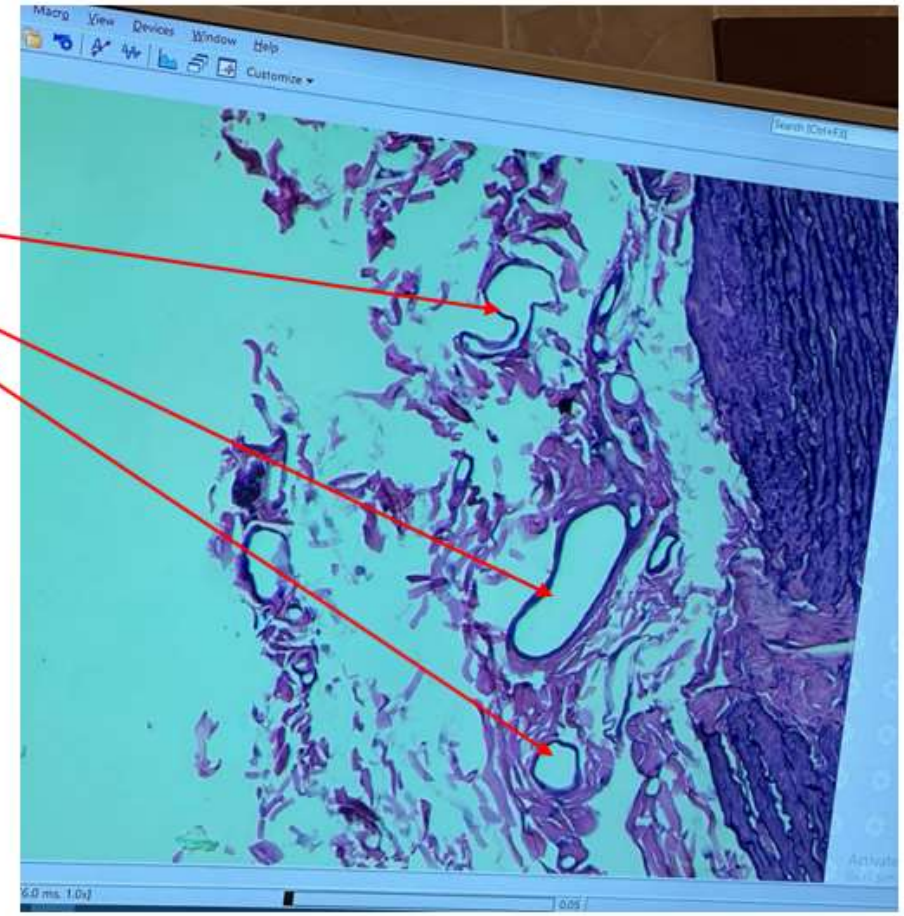


How to tell the difference between the small veins and arteries found within the vasa vasorum?

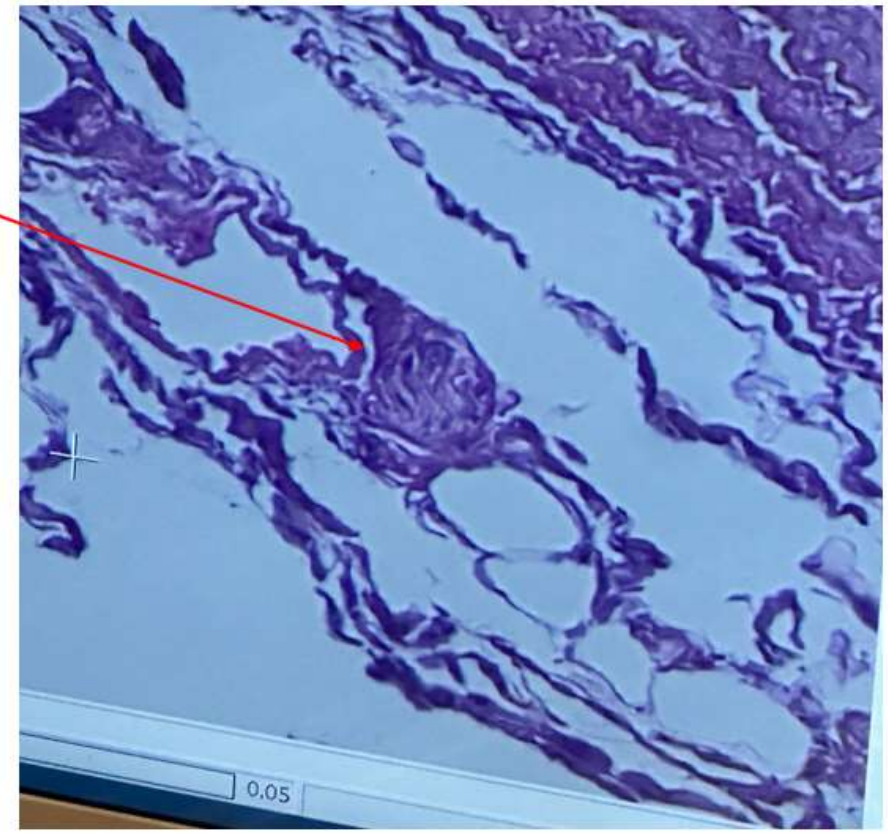
- The **ratio** of **the wall to lumen** for the artery is way greater than in the vein. (which indicates that the media is way more than in the veins and thus smaller lumen but thicker wall).

- The **ratio of the wall to the lumen** is remarkably low here, suggesting the presence **of small veins and venules** within the **vasa vasorum** observed in this section of the **aorta in the tunica adventitia**.

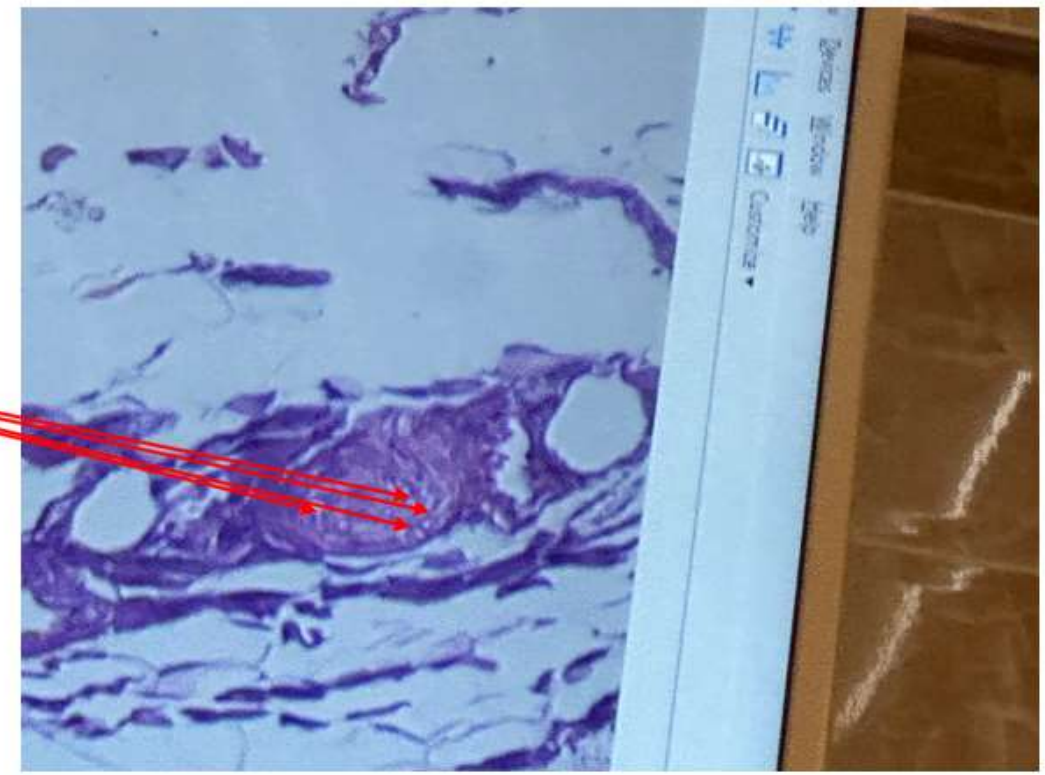
- The wall (layers) is about **1 to 2** cells/nuclei in capillaries. The venules have more than that, so they are thicker than capillaries but thinner than the arterioles.



- This is a part of a nerve in the tunica adventitia innervating this vessel.



- This is a part of a nerve in the tunica adventitia innervating the vessel, note the lumen how it is filled with **axons.**



- IN THIS PICTURE, note the lumen, the more the lumen is filled with blood means its thinner means it's a **venule**, the less the lumen filled with blood means its thicker means it's an **arteriole**.

- The red arrow indicates an arteriole/small artery, and the green arrow indicates a venule/small vein. الي بالصورة عبارة عن حزمة من الاوردة والشرايين التي تغذي النسيج, ماشيين مع بعض

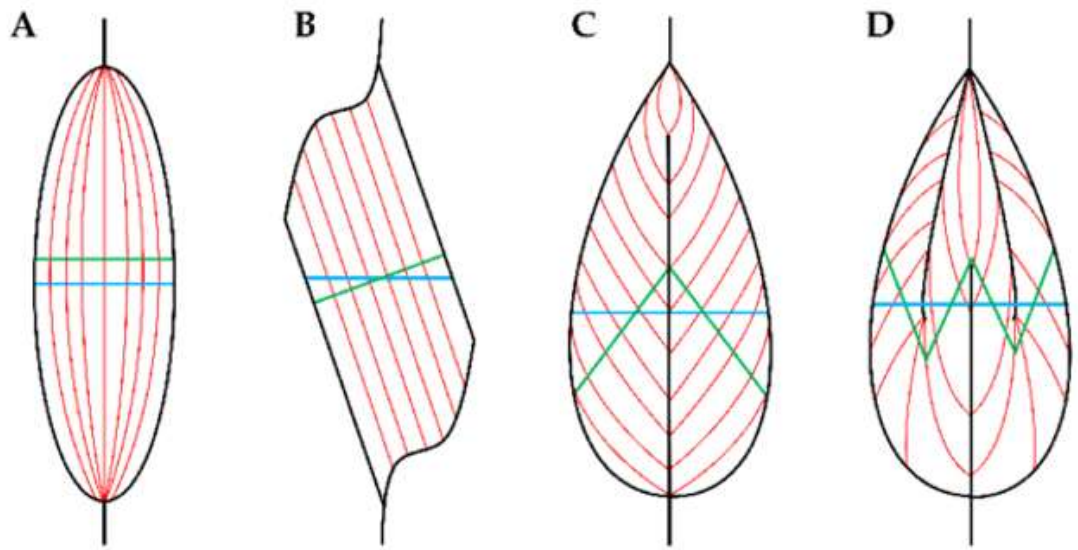
How to tell the difference between the large veins and medium sized veins?

- The **ratio** of **the adventitia to the media** for the large vein is way greater than in the medium vein, but the media in the medium size vein is greater than the media in the large vein (in the large vein, the media may even be poorly developed and spared around).

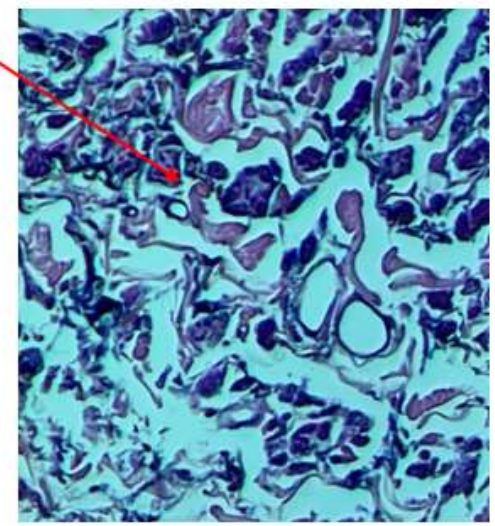
- In the media, concentric layers of **helically** arranged SMC'S are found.

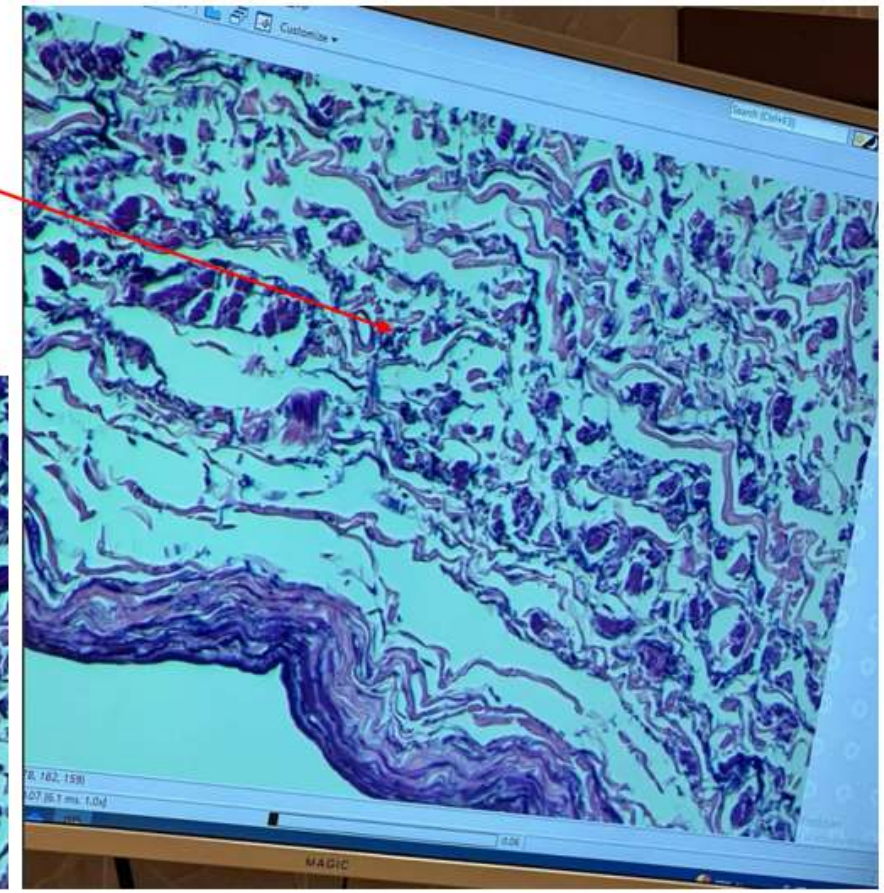
- In the adventitia, prominent bundles of SMC'S are in **longitudinal** arrangement.

- **The smooth muscle cells themselves exhibit a fusiform shape. Depending on the angle of the cut, different cross sections can result in various nucleus shapes, such as oval, elongated, or circular. (it gives an indicational orientation of the cut and the vessel)**



- Look at the adventitia of this large vein here (vena cava). Its so diffuse and its way more than the media, also pay attention to the vasa vasorum all around.

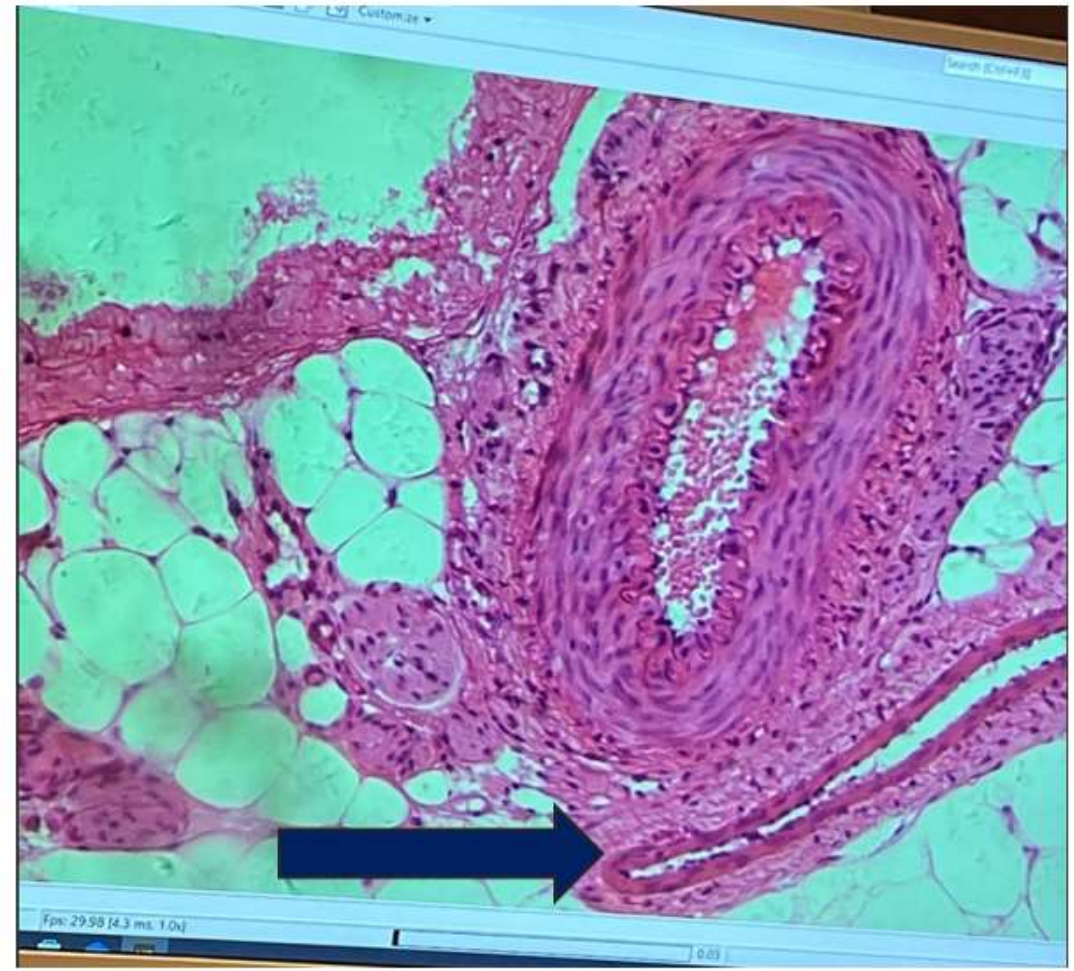




- Look at this medium sized artery, notice the **thick walls** and narrowed lumen. The lumen **is kind of collapsed due to an artifact during preparation** but don't confuse it with the vein even if the lumen looks like that. ما تعتمد ايضا على الفراغ الداخلي للوعاء لتحديدك للشريان او الوريد لانو مو دائما هيك وهذا مثال واضح

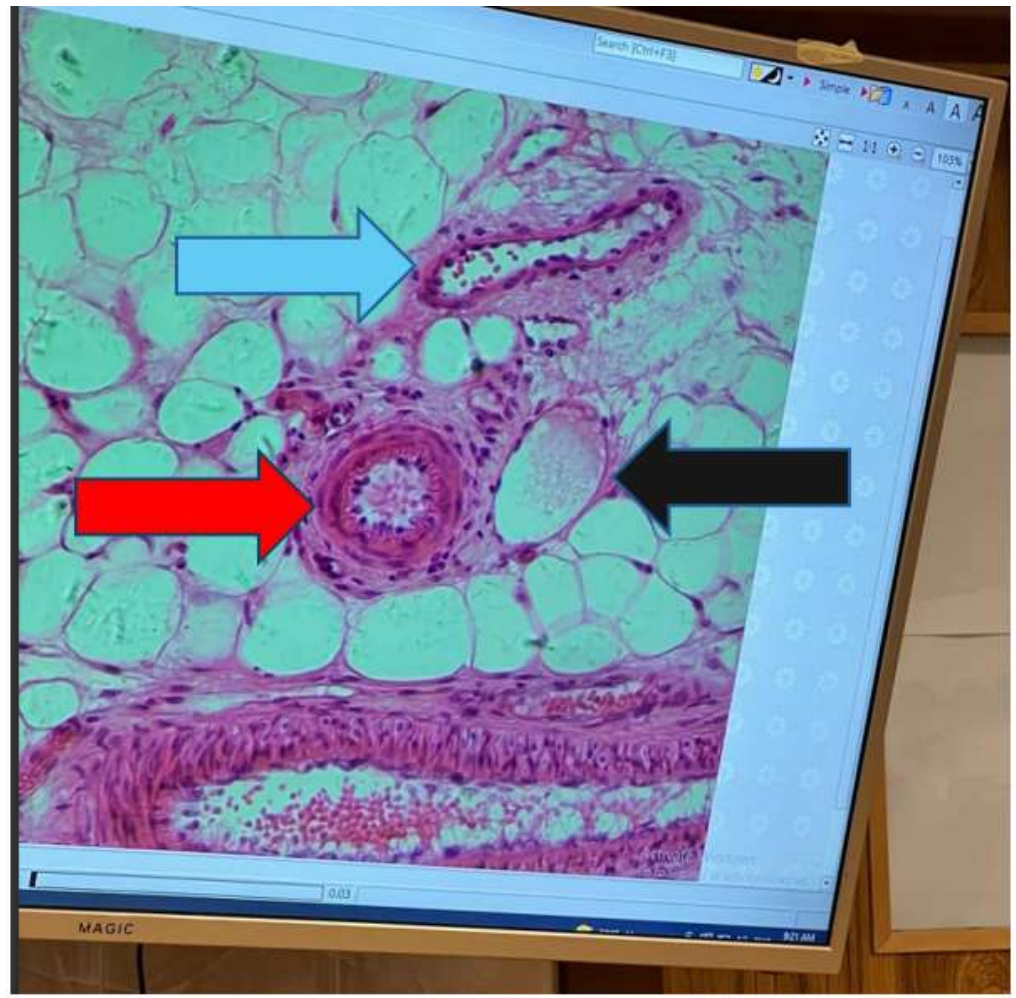
- The same as above but different picture.

- Look at this vein, notice the **thick adventitia** and collapsed lumen.



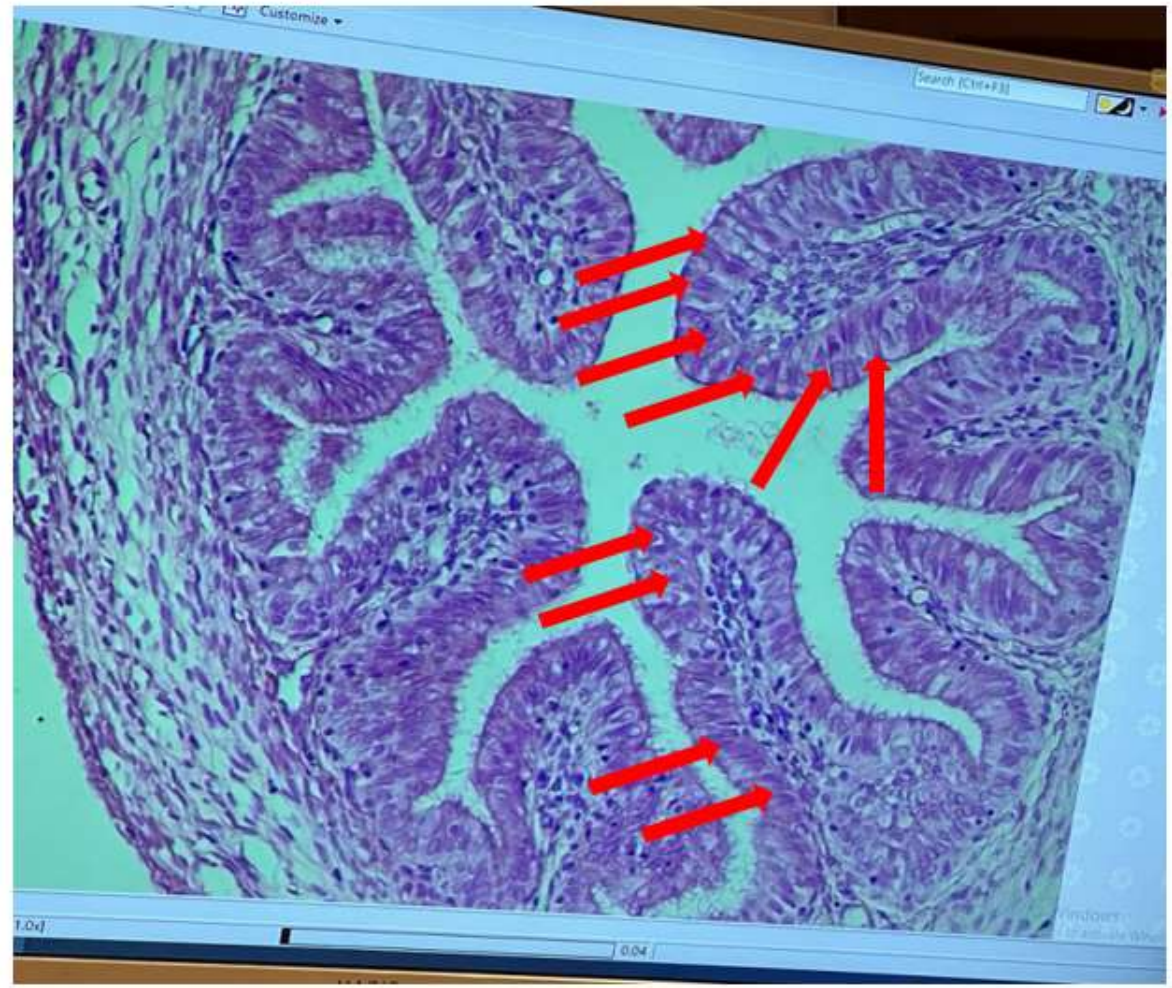
- Notice the **ratio of the lumen to the wall**, the red arrow indicates a small artery, the blue arrow indicates a small vein.

- The black arrow indicates a venule.



- What type of blood vessel is seen here in this picture? Is it a vein? Is it an artery? **This is NOT even a vessel.**

- Notice the lumen, its lined by columnar cells indicated by the arrows.

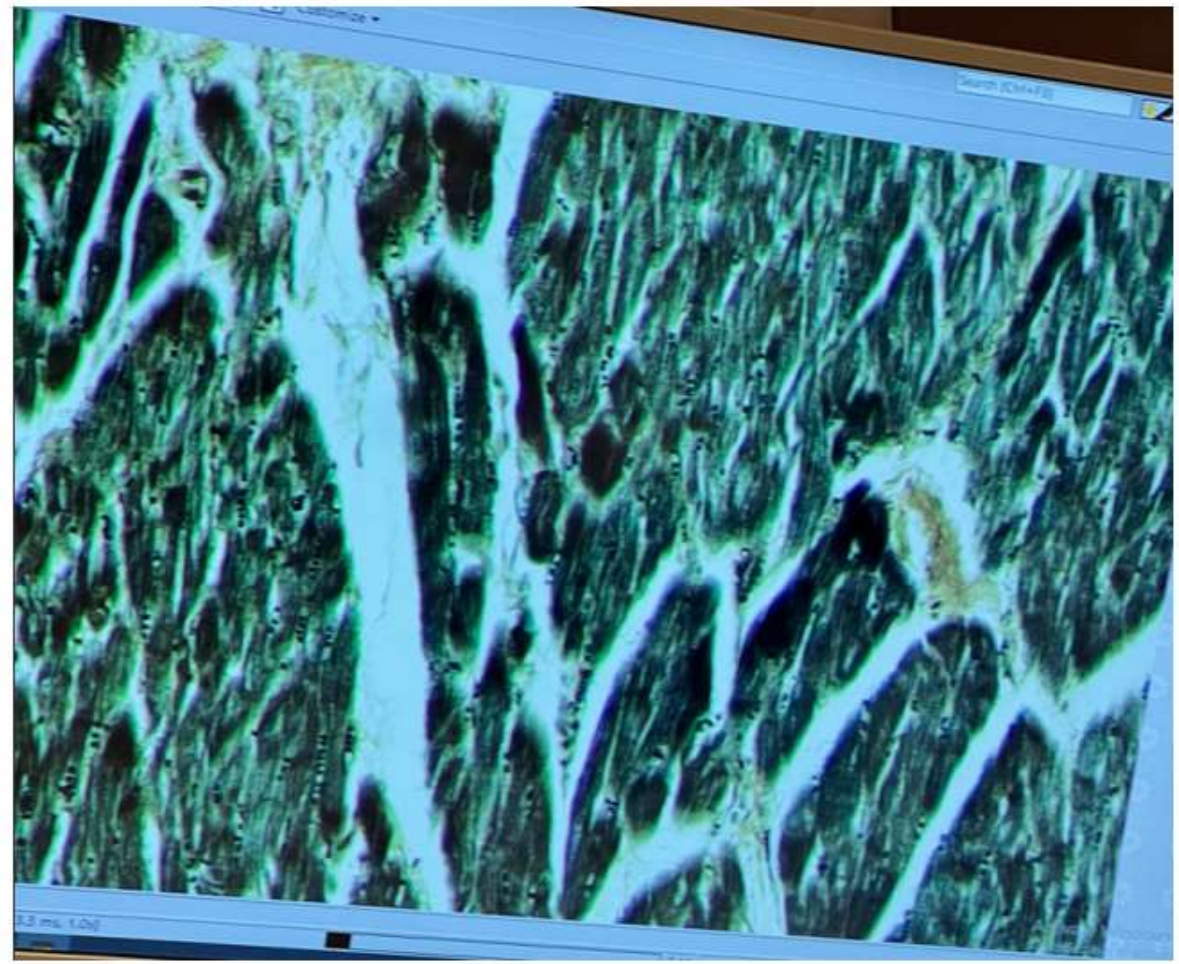


THE HEART

- This section show مجموعة من cardio myocytes.

- Note the intercalated discs between each branch.

- Cardiomyocytes, but different cut.



- Is this an endocardium or epicardium? If its endocardium, you would see the SQC epithelium and loose CT right beneath it, this is also **true** for the epicardium. ما منقدر نعتمدها بالتفريق

- The **main difference** here to consider between the EPI- and ENDO- cardium **is** the **FAT and vessels** that are supplying the heart muscle **at the sub-epicardium** layer.
- While وجود the **Purkinje fibers are seen here indicate the sub-endocardial layer.**

- **Purkinje fibers** characterized that they are bigger than the myocyte. Also, the myofilaments restricted to the periphery and mainly vacuolated in the middle. **Its within the SUB-ENDOCARDIAL layer, so its really close to the myocytes.**

THANK YOU

التفريغ صدقة جارية عن روح الزميل أحمد
اللهم إن رحمتك وسعت كل شيء, فارحمه رحمة تطمئن بها نفسه, وتقر بها عينه

Written by Momen Allala