النادي الطلابي
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Pathology CVS

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Veins and Lymphatics

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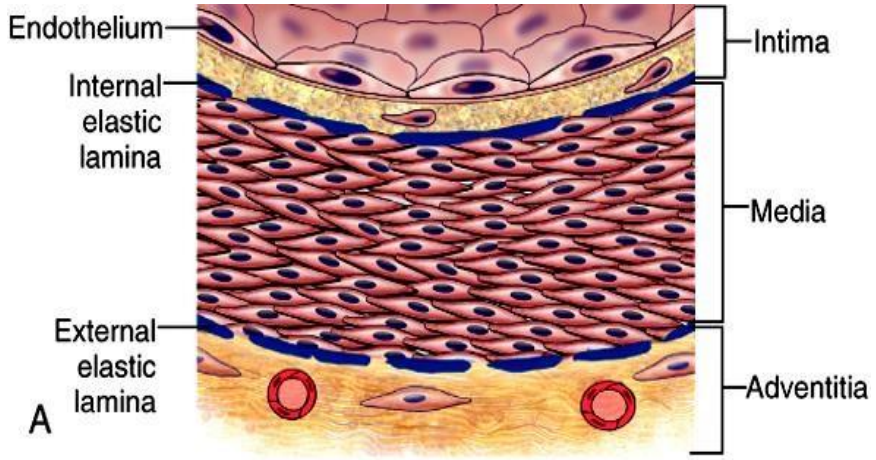
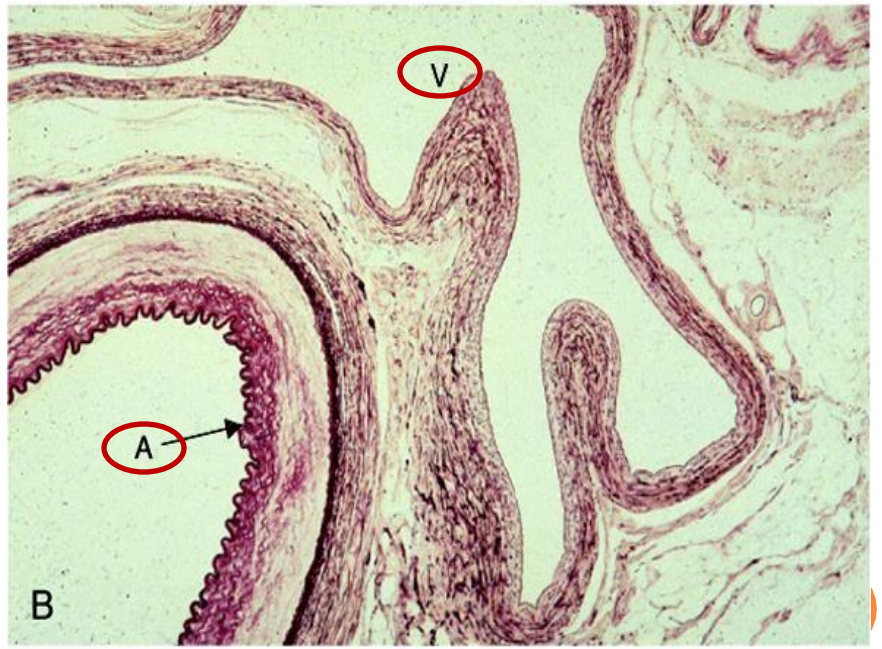
Histology of the blood vessels:
There are three layers within the wall of any blood vessel: : tunica intima, tunica media and tunica adventitia.
The intima is composed of **endothelial cells** and a thin layer of connective tissue, and it is bordered by internal elastic lamina.
The second layer is the media, which is mainly composed of **smooth muscle fibers**, and in some particular types of blood vessels we have elastic fibers as well. It is bounded from the outside by external elastic lamina. And then we have the adventitia where we have connective tissue, fibroblasts and some smaller sized blood vessels that give nourishment to the blood vessel wall. These are called vasa vasorum



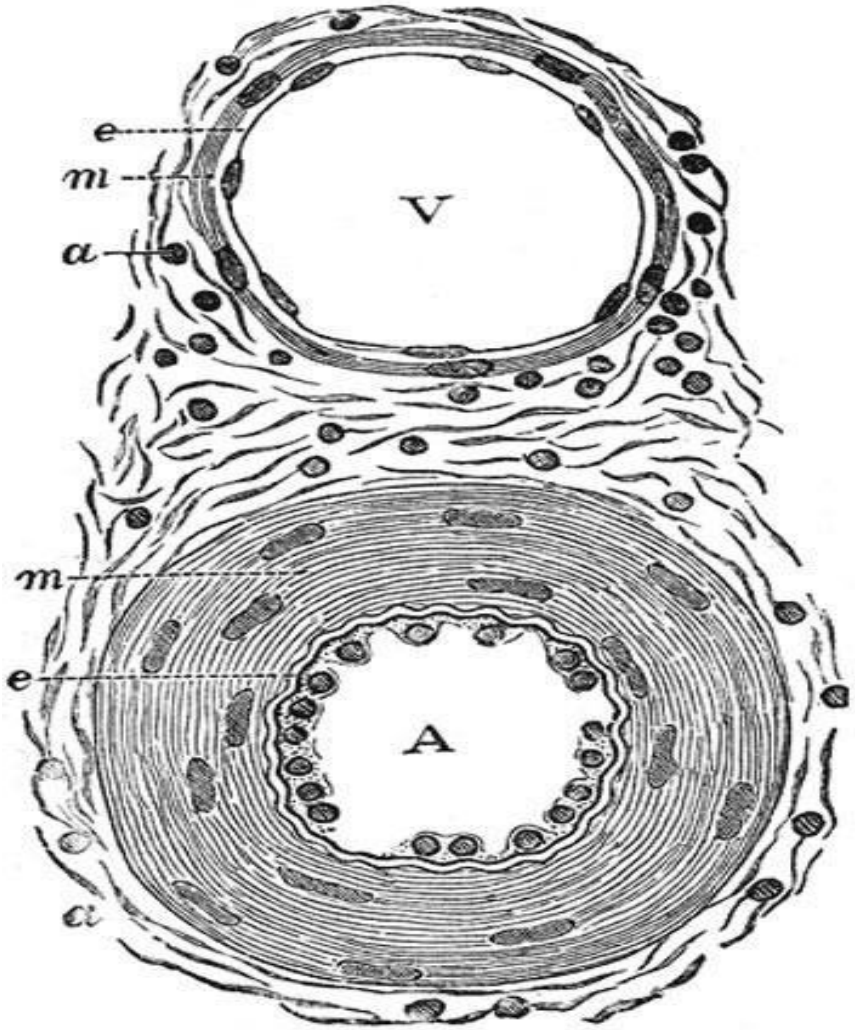
This is a microscopic picture showing us an artery and an adjacent vein
As you can notice, we have certain differences between veins and arteries.
Arteries have thicker walls; they look more rounded and more rigid. On the other hand, veins have thin walls that don't have well-developed media (without a good amount of smooth muscle in the media), they also have a low intraluminal pressure, that's why it's easy to compress and collapse veins and change its shape. So, arteries look like rigid pipes and veins tend to be collapsed.



ARTERY (A) VERSUS VEIN (V)

Another diagram for the comparison between arteries and veins :

- The point of similarity between arteries and veins is the presence of the three different layers within their walls (tunica intima, tunica media and tunica adventitia).
- The major difference between them is the **media layer**, which is much thicker and stronger in arteries than that in veins



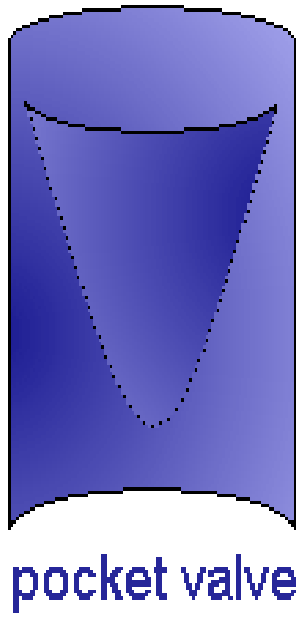
Normal vein physiology

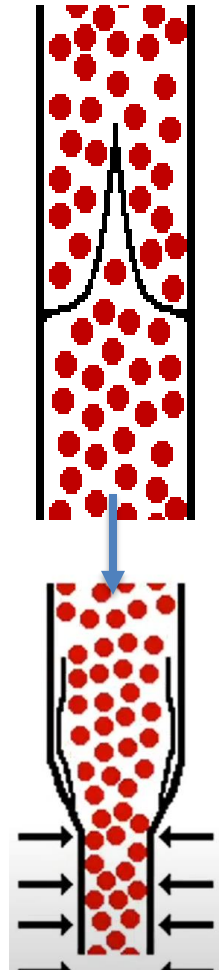
Go back to the video to see the animation
Time: 3:20

Veins in general, especially large veins of the lower limbs, contain these structures on the inside, they are called **pocket valve**. These pocket valves are found inside the veins, and they help in its function to return the blood from tissues back toward the heart within the venous blood flow.

So, as you can see, these pocket valves work as unidirectional valves allowing the blood to move in one direction outside the tissue and toward the heart. These arrows in the left and right figures represent the help that the vein gets from the surrounding skeletal muscles in performing its normal physiological function which is returning the blood towards the heart, and this effect is called **squeezing effect**.

Now, let's imagine that there is something wrong with these pocket valves or with the surrounding skeletal muscles, for example: the pocket valves are congenitally abnormal, or the surrounding skeletal muscles are weak for some reason or there is an increase in the intralumenal pressure within these veins for some reason, this might lead to a pathological process called **varicose veins.**





Pathology of Veins

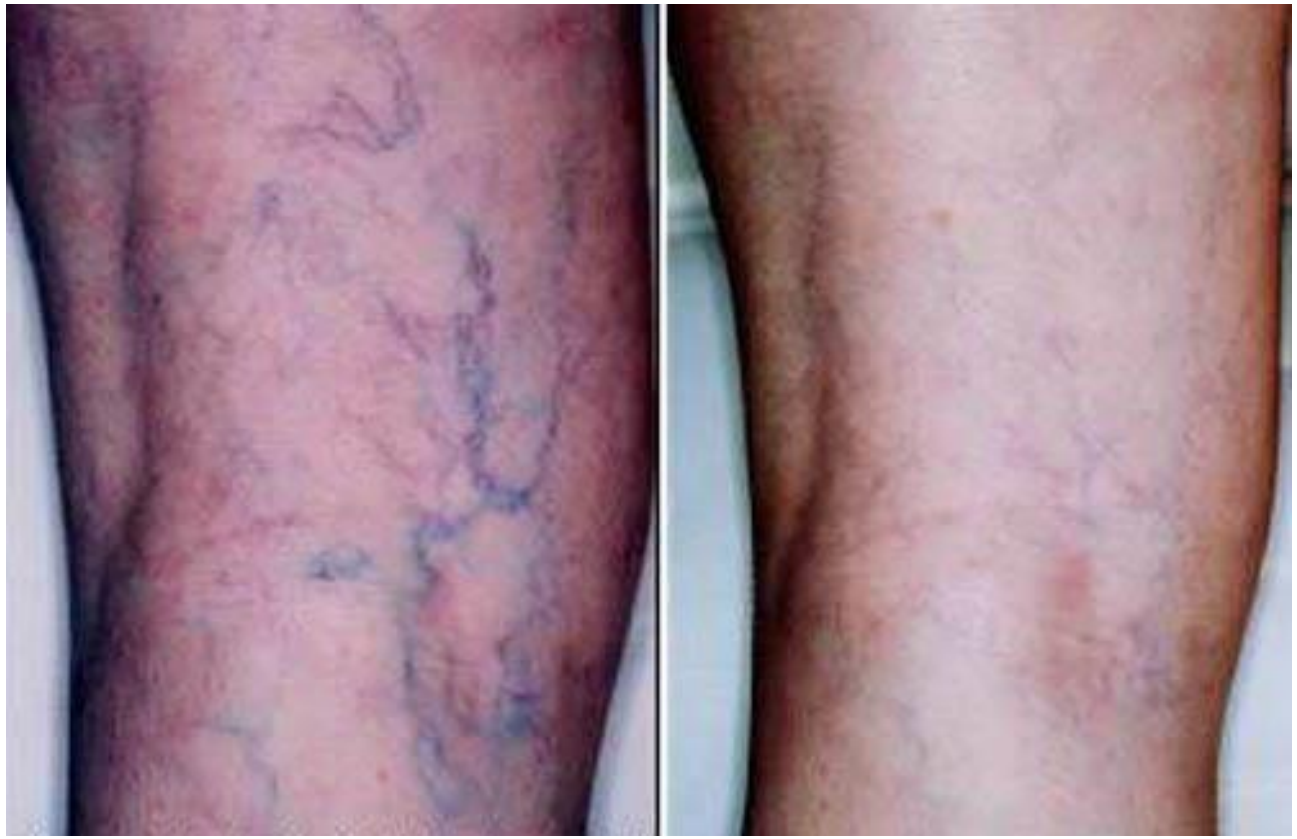
- **Varicose Veins**

- abnormally dilated, tortuous veins produced by prolonged increase in intra-luminal pressure and loss of vessel wall support.

- The superficial veins of the leg are most typically involved

(the most common location)

VARICOSE VEINS



After prolonged standing

Before

This is a picture of a patient's leg after two hours of standing. as you can see the major difference is the presence of tortuous and dilated bluish vessels under the skin and these are the **varicose veins**

Symptoms vary from one patient to another and can vary according to the location and the severity of the condition, and they include:

- Symptoms: venous stasis and edema (simple orthostatic edema)+ cosmetic effect of this problem, which is a major complaint in some patients

- 10% to 20% of adult males and > 30% of adult females develop lower extremity varicose veins

Risk factors

- Obesity
- Female gender
- Pregnancy
- Familial tendency (some families are known to develop premature varicosities results from imperfect venous wall development)

Microscopic Morphology

- Vein wall thinning
- intimal fibrosis in adjacent segments
- spotty medial calcifications (phlebosclerosis)
- Focal intraluminal thrombosis
- venous valve deformities (rolling and shortening), might be seen in cases where there are some congenital components of the problem

COMPLICATIONS

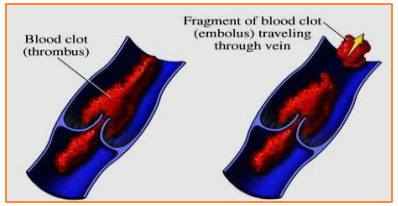
- **stasis, congestion, edema, pain, and thrombosis**

- **chronic varicose ulcers** by the development of skin ulcers overlying the site of varicosities, this is usually present in patients with comorbidities and other vascular problems and those who suffer from varicose veins for prolonged periods of time

- **embolism is very rare** (so it's not a major problem in superficial veins that develop varicosities)

THROMBOPHLEBITIS & PHLEBOTHROMBOSIS

- interchangeable terms (they mean the same thing)
  - Another problem that affects veins which is a very important condition ,Phlebothrombosis means formation of thrombus inside the vein. thrombophlebitis means thrombosis and inflammation in the venous wall
  - So, we have two processes happening inside the vein:



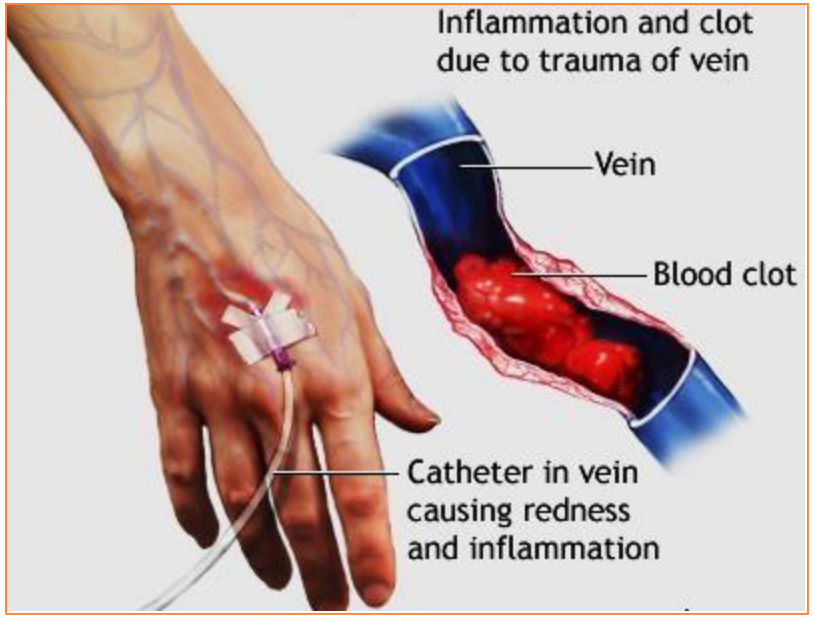
- **= Inflammation + thrombosis of veins**

some people say that thrombosis starts first, and this thrombosis will elicit or trigger inflammation of the wall, while others say that inflammation is the trigger that leads to thrombus formation.

- Most common site: deep leg veins (**90**% of all)
- **predispositions**: congestive heart failure, neoplasia, pregnancy, obesity, the postoperative state, and prolonged bed rest or immobilization (As you can see, all of these factors were discussed when we talked about risk factors for blood stasis. So, anything that leads to blood stasis especially in the venous circulation might act as a risk factor for development of thrombophlebitis)
- **local manifestations**: are variable and include local as well as systematic manifestations. The Local manifestations of thrombophlebitis include distal edema (distal to the site of occlusion), cyanosis, superficial vein dilation (because of the backflow of blood towards those veins), heat, tenderness, redness, swelling, and pain

Thrombophlebitis of upper limb veins is not common

- Thrombophlebitis of upper limb veins are usually associated with local risk factors like: catheter or canula site; or in some (rare) cases can be associated with systemic hypercoagulabilities.



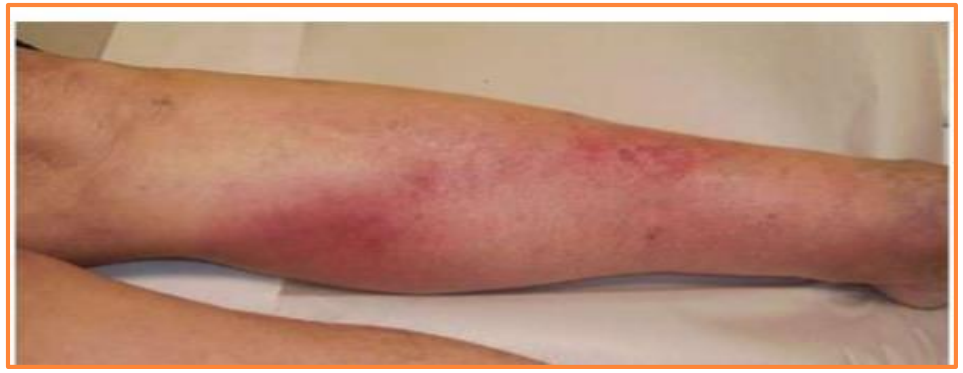
- **Special thrombophlebitis types:**

these syndromes are important because they might be a mark for an underlying significant disease

1- Migratory thrombophlebitis (Trousseau sign):

- hypercoagulability because of an underlying tumor occurs as a **paraneoplastic** syndrome related to tumor elaboration of pro- coagulant factors (e.g. colon cancer; pancreatic ca; etc…)

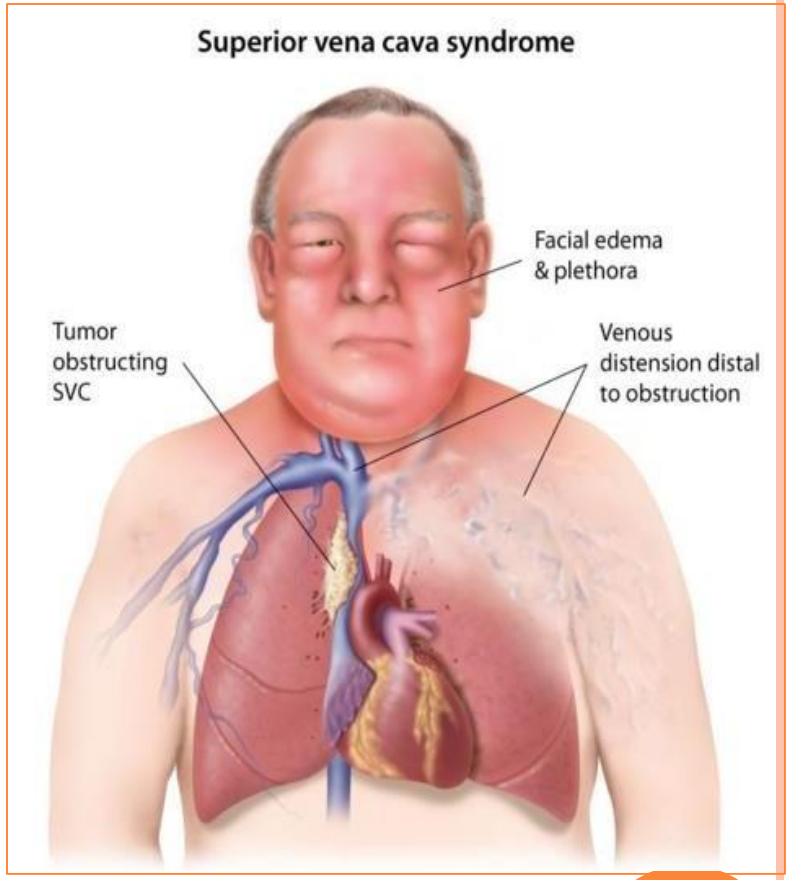
this cancer is a paraneoplastic syndrome that releases a substance into the circulation which works as a procoagulant factor, and this will lead to production of migratory thrombophlebitis and the patient will develop multiple areas of thrombophlebitis involving his extremities, abdomen or internal organ. These thrombophlebitis events will have a migratory pattern of occurrence (there will be some timelaps between the attacks).



2- THE SUPERIOR VENA CAVAL SYNDROME

The superior vena cava receives the venous blood back from the head, neck, upper limbs and upper part of the chest, and returns it into the heart.

- caused by neoplasms that compress or invade the superior vena cava
- Most common is lung cancer
- marked dilation of veins of head, neck, and arms with cyanosis

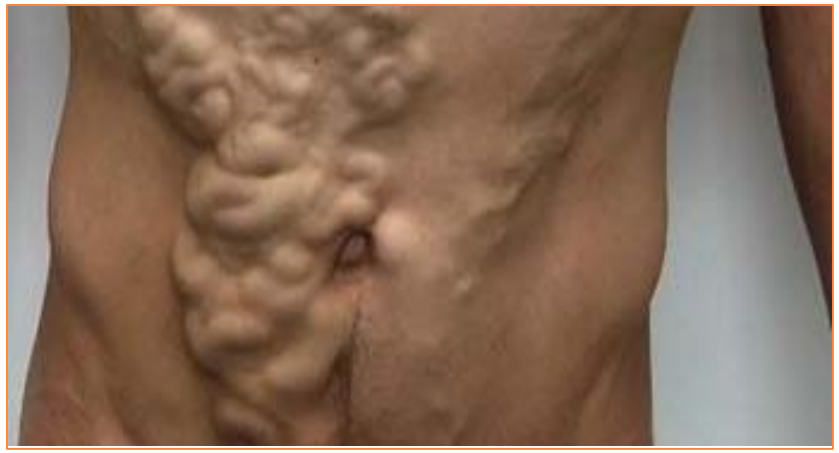


As we can see in the picture, this patient has a lung tumor that is obstructing his superior vena cava, this will lead to a backflow of venous blood towards the organs that were drained by the SVC, which are the head, neck, shoulders, upper limb and upper chest. So, the patient will complain from facial edema, plethora, congestion and distention of the veins distal to the obstructions.

3- INFERIOR VENA CAVAL SYNDROME

- caused by neoplasms compressing or invading inferior vena cava (m/c: hepatocellular carcinoma and renal cell carcinoma) → striking tendency to grow within veins

- marked lower extremity edema, distention of the superficial collateral veins of the lower abdomen (medusa)

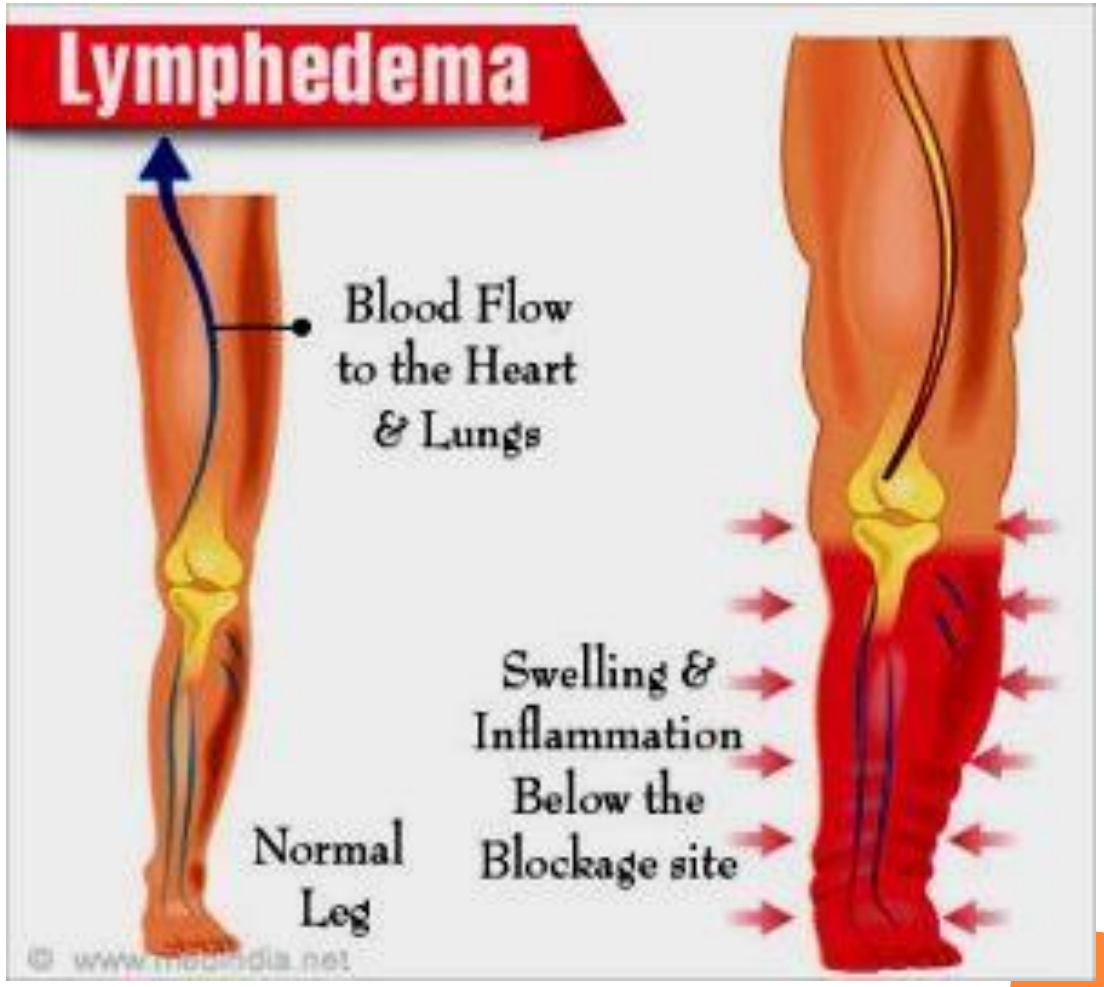


Pathology of Lymphatics

1	lymphedema
2	lymphangitis
3	chylous

As we all know, the lymphatics in our body help to return part of the interstitial fluid from tissues back into the venous blood and from there it will be back to the heart. So, the function of the lymphatic system is to return extra interstitial fluid and help in the venous return to the heart.

Now, if for some reason one of those lymphatics is obstructed, the interstitial fluid will accumulate within the tissues distal to the site of the blockage, with time this will lead to swelling and inflammation of the tissues below the level of the obstruction leading to the formation of lymph edema.



LYMPHEDEMA

Primary lymphedema usually manifests early in life during childhood

- can occur as:

1 **Primary (congenital) lymphedema** → lymphatic agenesis (lymphatics in certain locations of the body are completely absent) or hypoplasia (underdeveloped).

2 **Secondary (obstructive) lymphedema** → blockage of a previously normal lymphatic

Examples on causes that might lead to secondary lymphedema include :

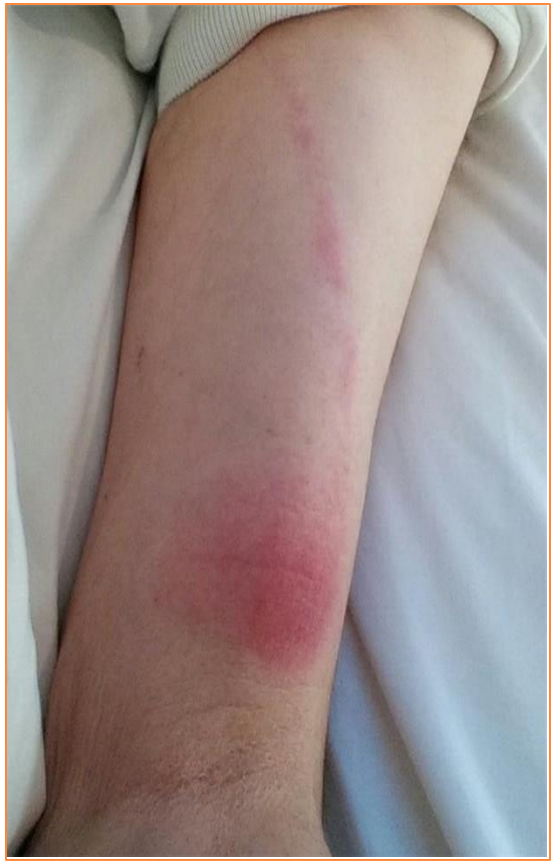
- Malignant tumors
- Surgical procedures removing lymph nodes (e.x: the surgical procedure that is used to treat breast cancer which includes removal of the tumor, breast tissue and the ipsilateral axillary lymph node)
- Post-irradiation
- Fibrosis at the site of the affected lymphatic
- Filariasis (parasitic infection that leads to inflammation, destruction and occlusion of the lymphatic vessels within the affected limb)
- Postinflammatory thrombosis and scarring at the site of the previous inflammation

This is a picture showing lymphedema, as you can see the huge distention and swelling of the affected limb.

LYMPHANGITIS

ITIS =inflammation, ANG = vessel

- acute **inflammation** due to bacterial infections spreading into lymphatics
- m/c are **group A β-hemolytic streptococci**.
- lymphatics are **dilated** and filled with an **exudate** of neutrophils and monocytes.
- **red, painful subcutaneous streaks** (inflamed lymphatics), with painful enlargement of the draining lymph nodes (acute **lymphadenitis**).
- Sometimes, subsequent passage into the venous circulation can result in bacteremia or sepsis (especially in immunocompromised patients).



CHYLOUS

The word chylous comes from the milky appearance color and consistency of the accumulated fluid

- Milky accumulations of lymph in various body cavities (the accumulation of lymph doesn't happen within the interstitial spaces of tissues, it happens within the body cavities, and we have three body cavities that might develop lymphatic accumulation: The pleural cavity, the pericardium and the peritoneum)
- caused by rupture of dilated lymphatics, typically obstructed secondary to an infiltrating tumor mass (The most important mechanism of development of chylous)
- types

- chylous ascites (abdomen,(where the accumulation happens within the peritoneal cavity))

- **Chylothorax (chest** (within the pleural cavity))
- **Chylopericardium (pericardium)**