



# CVS PATHOLOGY



Modified NO:



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الدكتور:

# Veins and Lymphatics

## Color code

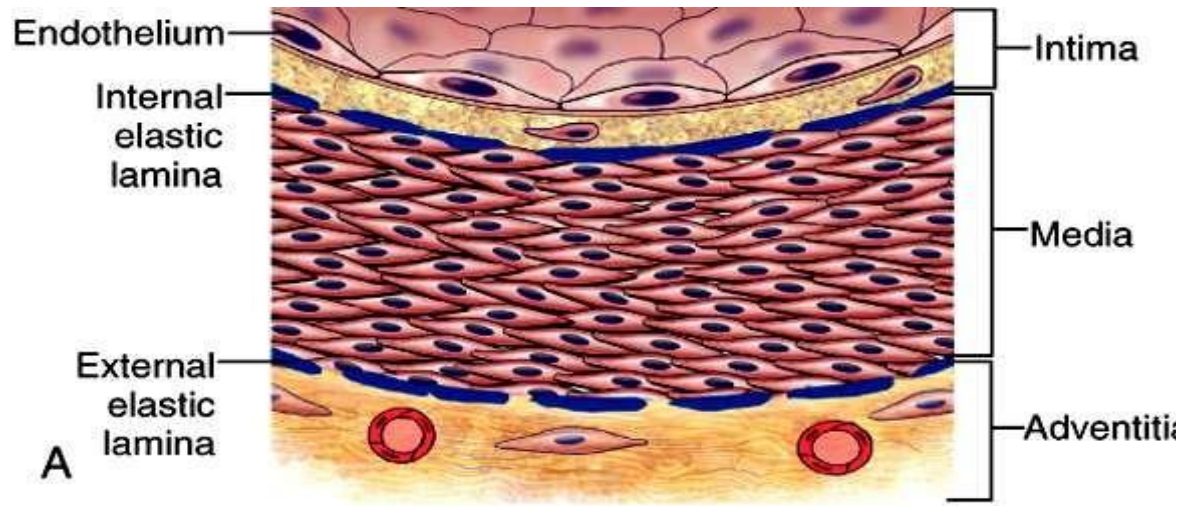
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Slides

Doctor

Additional info

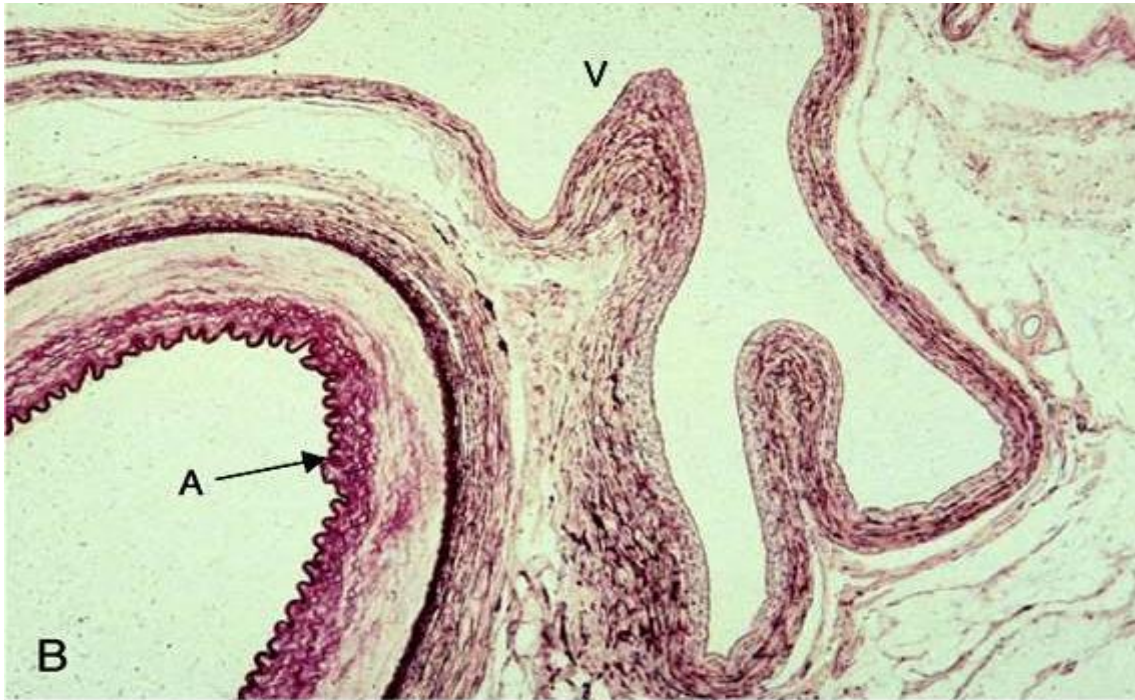
Important



- Here is a quick revision of the normal histology of blood vessels.

- As we have learned before, there are three layers within the wall of any blood vessel.
- The first layer is the **intima** is composed of endothelial cells and a thin layer of connective tissue. It is bordered by the internal elastic lamina.
- The second layer is the **media**, which consists mainly of smooth muscle fibers. In certain types of vessels, elastic fibers are also present. This layer is bordered externally by the external elastic lamina.
- The third layer is the **adventitia**, which contains connective tissue, fibroblasts, and smaller blood vessels that provide nourishment to the vessel wall. These small vessels are called vasa vasorum.

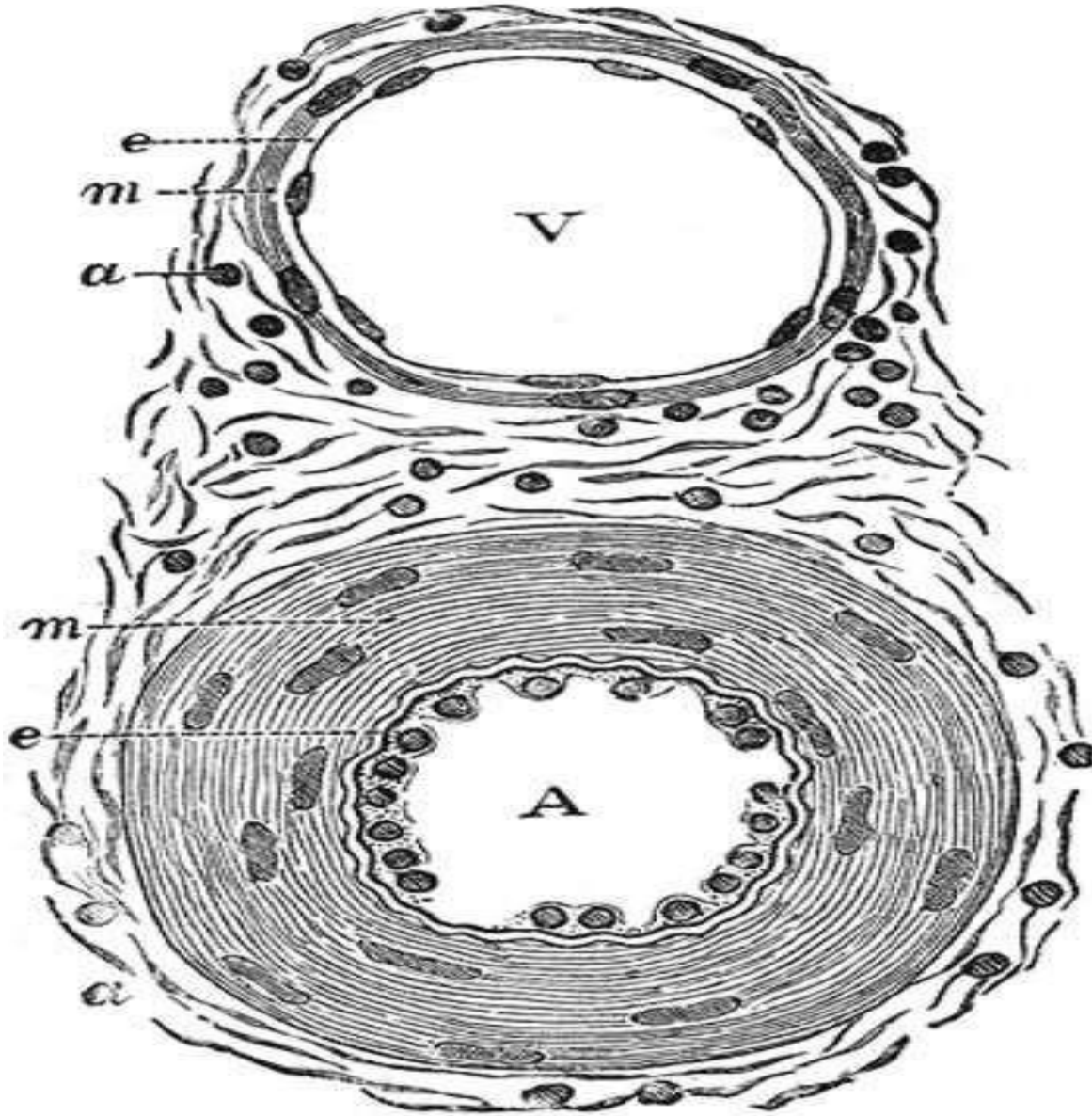




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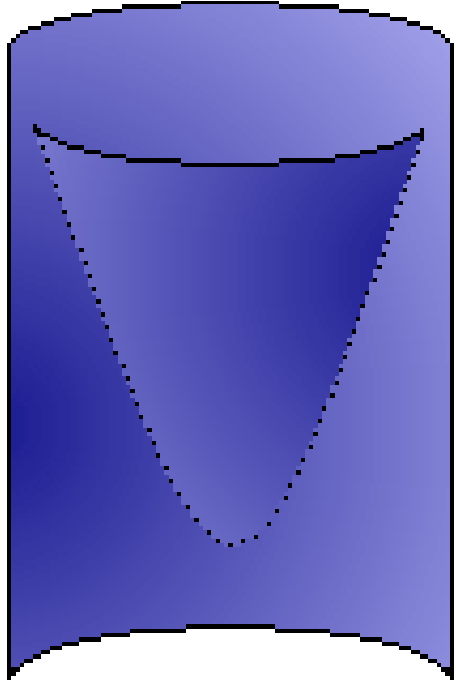
- This picture is a microscopic picture showing an artery and a vein.
- There are certain differences between arteries and veins:
  - Arteries have thicker walls, appear more rounded, and are more rigid. In contrast, veins have thinner walls with a less developed media (containing lower amounts of smooth muscle). This is why veins often appear collapsed and have lower internal pressure.
  - So, we can understand from this picture that it's easy to compress, collapse and change the shape of the vein.

# ARTERY (A) VERSUS VEIN (V)



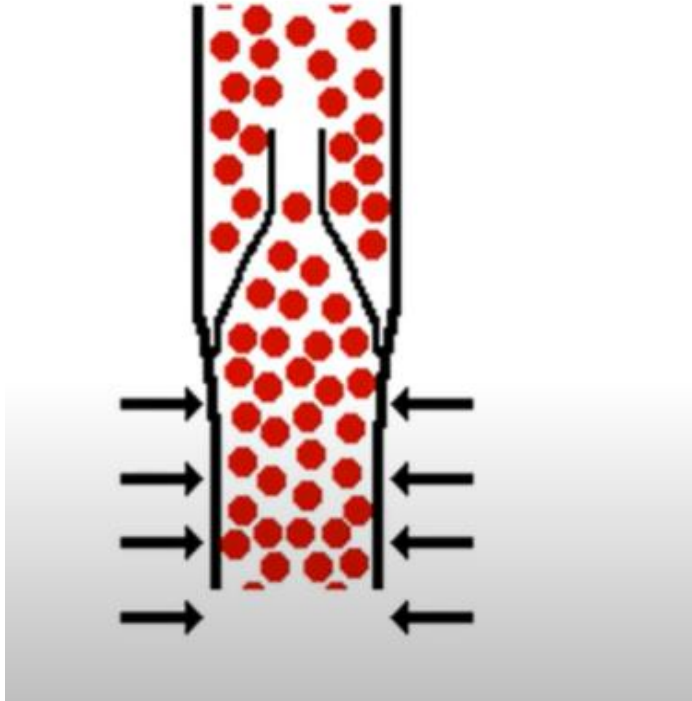
- Another diagram for the comparison between the structure of an artery and vein shows the following:
  - The point of similarity between arteries and veins is the presence of the three different layers within their walls.
  - The major difference is the media layer, which is much thicker and stronger in arteries than that in veins.

# Normal vein physiology



pocket valve

- Before we dive into the pathologies of veins, we need to understand what a normal vein physiology is.
- Veins in general, especially large veins of the lower limbs, contain structures from inside that are called **pocket valve**. These 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.



- 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.

- The arrows represent the assistance that veins receive from surrounding structures in performing their normal physiological function of returning venous blood to the heart. Specifically, the arrows indicate the role of surrounding skeletal muscles, which help veins maintain their function through a process known as the "squeezing effect."

- Now imagine that here is something wrong with these valves or skeletal muscles, for example, congenitally abnormal pocket valves or weakness in the surrounding skeletal muscle for some reason or even an increase in the intraluminal pressure within these veins for any reason. All these abnormalities may 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 picture is from the same patient, showing the leg before and after two hours of standing. As you can see, the main difference is the appearance of tortuous and dilated bluish vessels under the skin, which are **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:

1. venous stasis and 2. edema (simple orthostatic edema) and 3. cosmetic effect (which is a major complaint in some patients.)

- Varicose veins is quite common, it can affect 10% to 20% of adult males and > 30% of adult females develop lower extremity varicose veins.

# RISK FACTORS

- Obesity
- Female gender
- Pregnancy
- Familial tendency (premature varicosities results from imperfect venous wall development)

# Microscopic Morphology

- If we take a vein that is involved in varicosities and look at it under the microscope, we might see the following findings:
  - Vein wall thinning
  - intimal fibrosis in adjacent segments
  - spotty medial calcifications (phlebosclerosis)
  - Focal intraluminal thrombosis
  - venous valve deformities (rolling and shortening) ->> in cases where there are some congenital components of the problem.



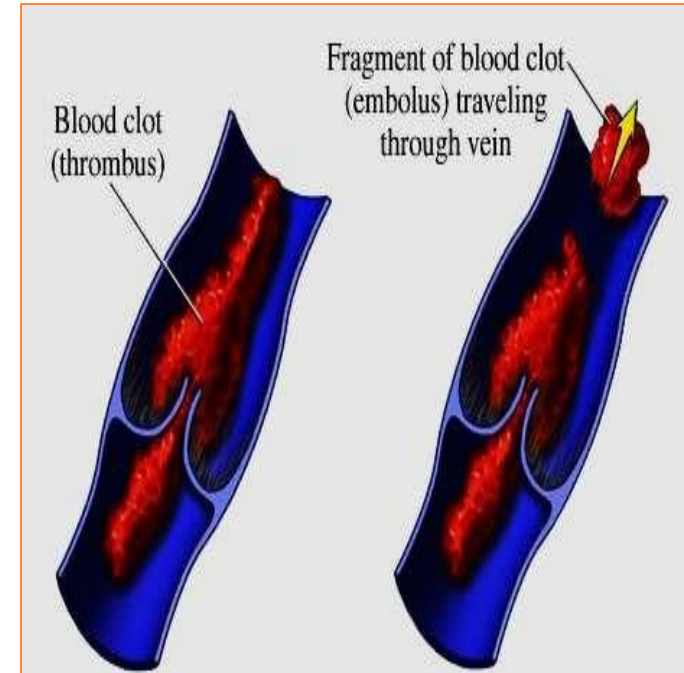
# COMPLICATIONS

- **stasis, congestion, edema, pain, and thrombosis**
- **chronic varicose ulcers** (which is the development of skin ulcers overlying the site of varicosities).
- **embolism is very rare** (so it's not a major problem in superficial veins that develop varicosities).

# THROMBOPHLEBITIS & PHLEBOTHROMBOSIS

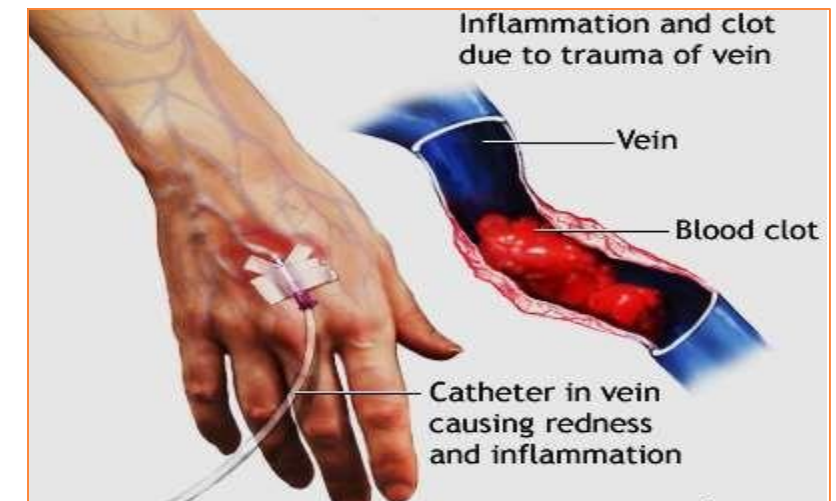
Another problem that affects veins: (very important condition that you need to understand and to know some information about)

- interchangeable terms (both terms mean the same thing, phlebo = veins, thrombosis = formation of thrombus inside the vein, -itis = inflammation in the venous wall)
- ○ = **Inflammation + thrombosis of veins**
- We have two process that happen inside the vein but which process happens first? Some people say that thrombosis starts first and it will elicit an inflammation of the wall, 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.
- All these factors have been discussed when we talked about risk factors for venous stasis / blood stasis / abnormal blood flow so, anything that leads to blood stasis (especially on the venous side of the circulation) might act as a risk factor for developing thrombophlebitis.
- Clinical manifestations of thrombophlebitis are variable and include local as well as systemic manifestations.
- **local manifestations:** distal edema (distal to the side of occlusion), cyanosis (of the affected limb), superficial vein dilation (because of the backflow of blood towards those veins), heat, tenderness, redness, swelling, and pain

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- Thrombophlebitis of upper limb veins it's not quite common but when it's present it's usually associated with local risk factors like: catheter or canula site; or in some cases (rare cases) can be associated with systemic hypercoagulabilities.



## ○ Special thrombophlebitis types:

These thrombophlebitis syndromes are important because they might be a mark for an underlying significant disease.

### 1- Migratory thrombophlebitis (Trousseau sign):

- hypercoagulability occurs as a **paraneoplastic** syndrome related to tumor elaboration of pro- coagulant factors (e.g. colon cancer; pancreatic cancer, stomach cancer; etc...)

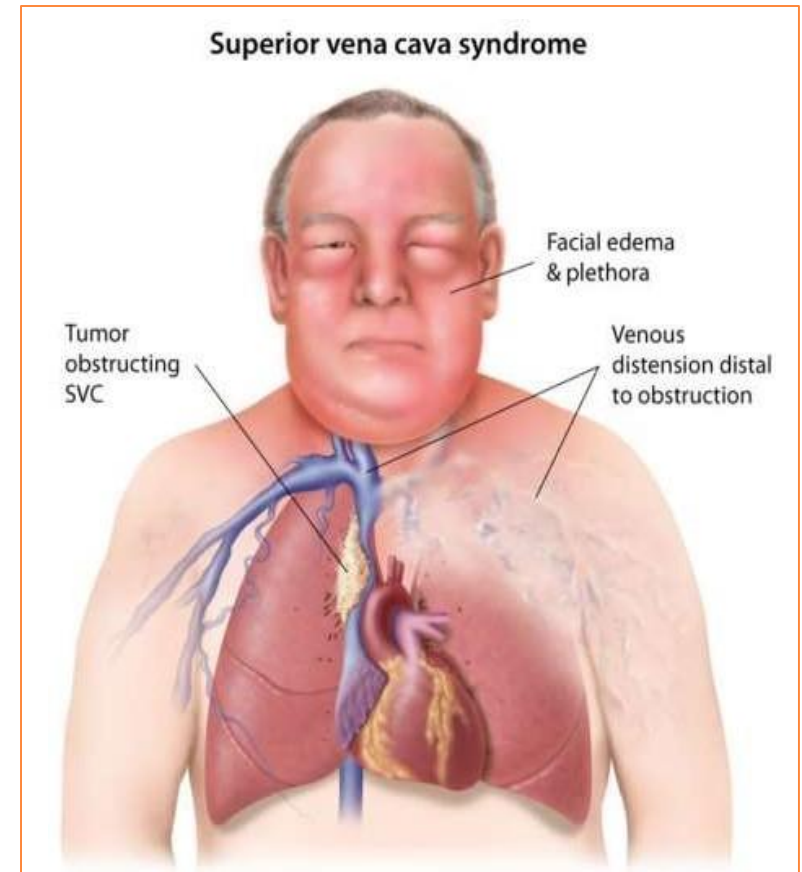
In other words, the patient develops hypercoagulability because of an underlying tumor, this cancer as a paraneoplastic syndrome releases into the circulation a substance that works as pro-coagulant factor, developing multiple areas of thrombophlebitis involving extremities, abdomen or internal organs, and these thrombophlebitis events will have a migratory pattern of occurrence (there will be sometimes lapse between attacks).





# 2- THE SUPERIOR VENA CAVAL SYNDROME

- As you know, SVC receives the venous blood back from head, neck, shoulders, upper limbs and the 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
- In this picture, the patient has lung cancer that is obstructing his SVC leading to backflow of the venous blood towards organs that were drained by SVC.
- The patient will complain of facial edema, plethora, congestion and distention of the veins distal to the obstruction, so we'll see distended and dilated veins of the upper limbs, shoulders, upper chest... along with cyanosis and edema of these organs.



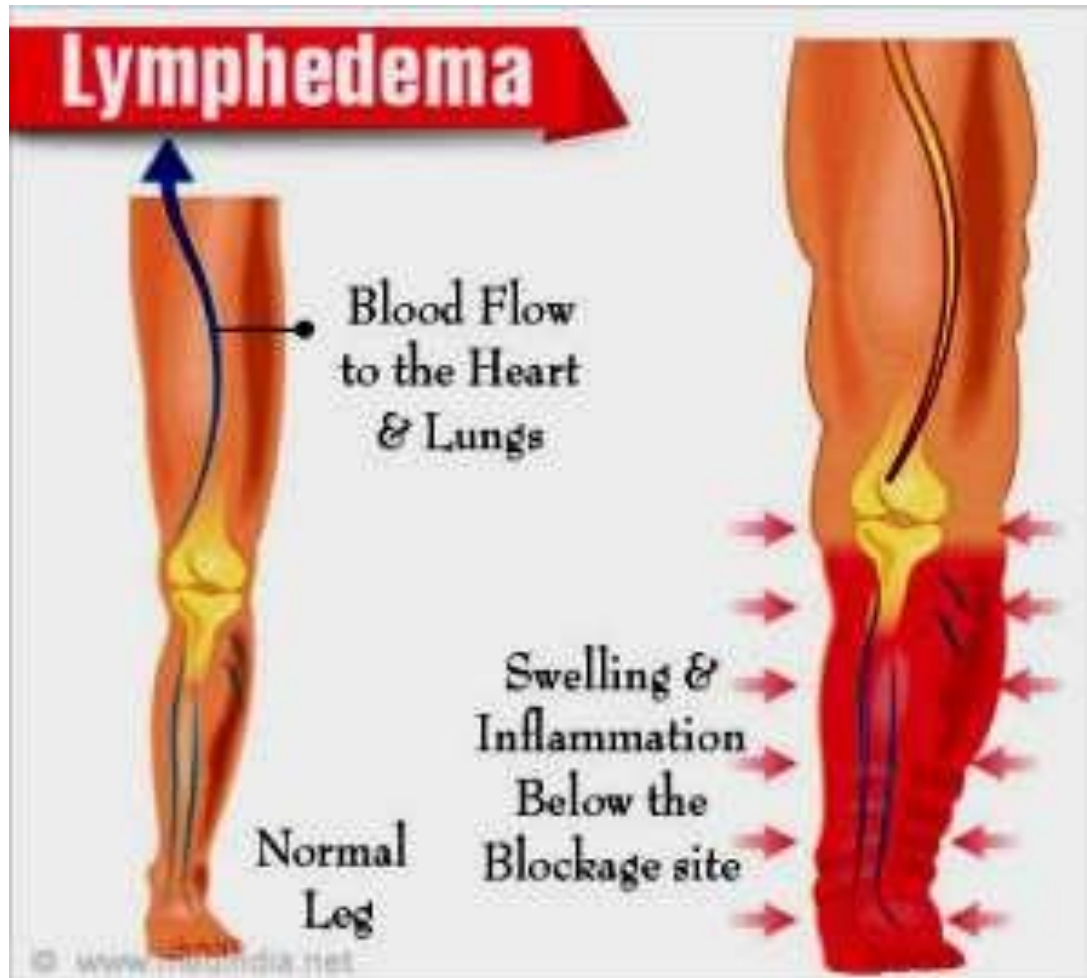
# 3- INFERIOR VENA CAVAL SYNDROME

- caused by neoplasms compressing or invading inferior vena cava (m/c (most commonly): hepatocellular carcinoma and renal cell carcinoma (within the kidney))  
→ These tumors are famous for having a striking tendency to grow within veins
- marked lower extremity edema, distention of the superficial collateral veins of the lower abdomen (or what we call the medusa head)



# Pathology of Lymphatics

- 1 lymphedema
- 2 lymphangitis
- 3 chylous



Lymphedema means the presence of edema that is a result of lymph.

Lymphatics in our bodies help to return a part of the interstitial fluid from tissues back into the venous blood and from there it will go back to the heart.

So, the function of lymphatic system is to return the extra interstitial fluid and to help in the venous return to the heart.

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



# LYMPHEDEMA

○ can occur as:

## 1 Primary (congenital) lymphedema →

lymphatic agenesis (the lymphatic in a certain location in the body is completely absent) OR hypoplasia (it's underdeveloped).

Primary lymphedema usually manifests early in life during childhood.

## 2 Secondary (obstructive) lymphedema (which is much more common than primary lymphedema) → blockage of a previously normal lymphatic

## Examples of causes that might lead to secondary lymphedema:

- Malignant tumors
- Surgical procedures removing lymph nodes for example, the surgical procedure that is used to treat breast cancer, breast cancer treatment includes mastectomy (removal of the tumor and breast tissue + removal of ipsilateral axillary lymph nodes).
- Post-irradiation
- Fibrosis at the site of the affected lymphatic.
- Filariasis which a parasitic infection that leads to inflammation, destruction and occlusion of the lymphatic vessels within the affected limb.
- Anything that leads to inflammation with associated Post inflammatory thrombosis and scarring at the site of the previous inflammation.



# LYMPHANGITIS

-itis = inflammation, ANG- = vessel, so this condition refers to inflammation in lymphatic vessel.

- acute **inflammation** due to bacterial infections spreading into lymphatics (almost always).
- m/c are **group A  $\beta$ -hemolytic streptococci**.
- lymphatics are **dilated** and filled with an **exudate** of neutrophils and monocytes (because of inflammation).
- **The affected site will show: red, painful subcutaneous streaks** (inflamed lymphatics), with painful enlargement of the draining lymph nodes (acute **lymphadenitis**).
- Sometimes, subsequent passage -of this inflammation- 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
- In this condition, the accumulation of lymph doesn't happen within the interstitial spaces of tissues, it happens within body cavities (we have 3 body cavities that might develop lymphatic accumulations: the pleural cavity, pericardium and the peritoneum).
- The most important mechanism of developing chylous is rupture of dilated lymphatics, typically obstructed secondary to an infiltrating tumor mass
- Types (depends on the location of chylous accumulation):
  - **chylous ascites** (abdomen / peritoneal cavity)
  - **Chylothorax** (chest / pleural cavity)
  - **Chylopericardium** (pericardium)



## E-learning Questions:

1. The major structural difference between artery and vein is:

- A. Smooth muscles layer (media) is thicker in the artery
- B. Absence of endothelial cells in veins
- C. The number of layers in the wall

2. All of the following are things that help the veins in the process of venous blood return, except ONE:

- A. Gravity
- B. Skeletal muscles surrounding the veins
- C. pocket valves inside the veins

3. Inferior vena cava syndrome is most commonly caused by colon cancer

- A. True
- B. False

4. The most important causative microorganism of lymphangitis is:

- A. Bacteria
- B. Viruses
- C. Fungi

**Answers: A,A,B,A**

## E-learning Questions:

5. Which statements are correct regarding superficial varicose veins:

More frequent in males

congestion and edema are possible complications ✓

most common in superficial veins of the upper limbs

maybe aggravated by obesity ✓

pressure on pelvic veins by the pregnant uterus may be a cause ✓



## Additional sources

VERSIONS	SLIDE #	BEFORE CORRECTION	AFTER CORRECTION
V1→ V2			
V2→V3			



امسح الرمز و شاركنا بأفكارك لتحسين أدائنا!!