



Venous diseases

Objectives:

- State the normal anatomy of venous system of the lower limb
- Describe the pathogenesis, presentation, investigation, complications & management of varicose veins
- Describe chronic venous insufficiency of lower limb & its management

Resources:

- Davidson's
- Slides

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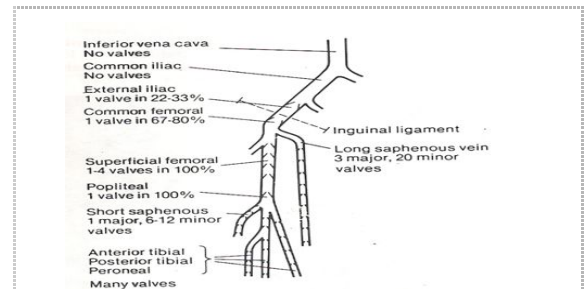
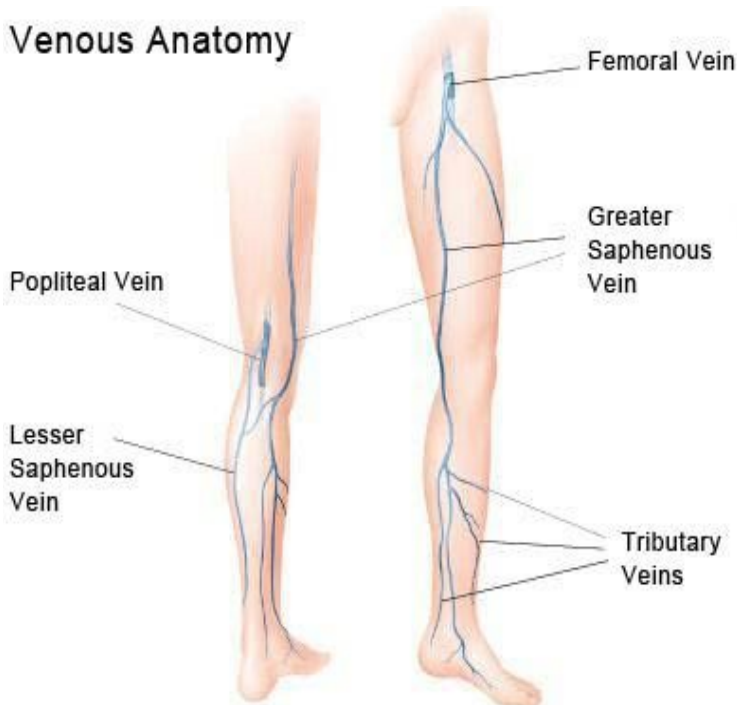
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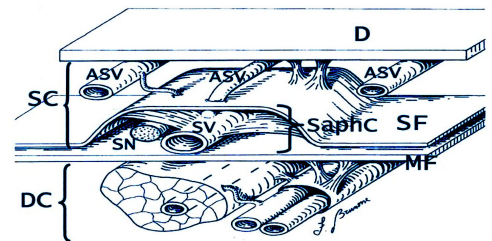
Basic Review(Anatomy of the venous system) :

Superficial veins	Deep veins	perforators
<p>They lie just beneath the skin, and they have valves that make the blood go upward.</p> <p>Like GSV¹ and LSV²:</p> <ul style="list-style-type: none"> • GSV: originates from the <u>medial</u> end of the dorsal arch, then it goes <u>in front</u> of the medial malleolus to ascend to the medial thigh, then it joins the common femoral vein at the Sapheno-femoral junction (SFJ) (at the groin). • LSV: originates from the <u>lateral</u> end of the dorsal arch, then it passes <u>posteriorly</u> to the lateral malleolus to ascend to the back of the leg, then it joins the popliteal vein at the Sapheno-popliteal junction. 	<p>They lie deeply <u>within the muscles</u> and they also accompany arteries (usually have the same names). Their valvular system allows the blood to travel upward.</p>	<p>They are like bridges that connect the superficial and deep veins together. Their valvular system allows the blood to move inward. The flow is normally from the <u>superficial to the deep veins</u>.</p>

Venous Anatomy



Notice that there are no valves in IVC and common iliac but the number of valves increases distally.



An image showing the location of saphenous vein (SV) and its relation to deep veins.

¹ Great Saphenous Vein

² Lesser Saphenous Vein

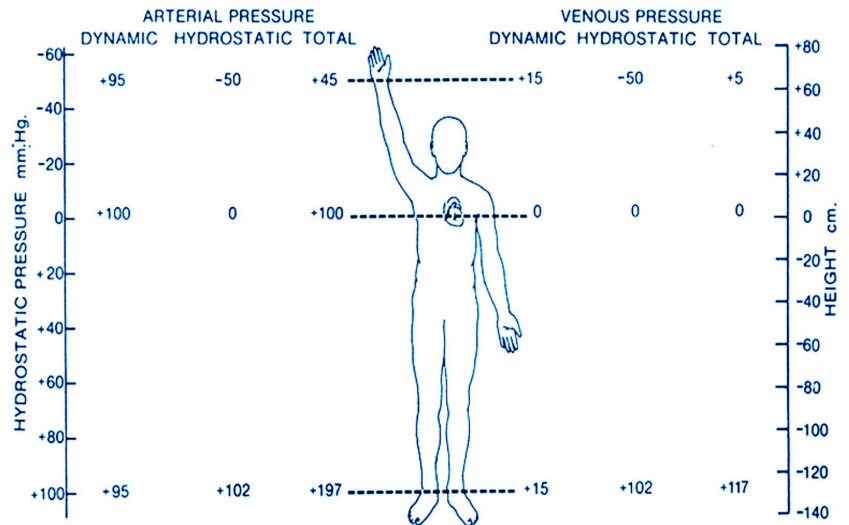
Basic Review (Physiology):

Pressures Acting on Blood Vessels:

Blood in any vessel in the body is controlled by two pressures:

1- Hydrostatic Pressure (atmospheric pressure): the pressure of blood on the walls of the vessel.

- Due to gravity, it's greater in inferior distal portions of lower limb vessels, like the ankles and less in upper limb vessels.
- It's equal in both arteries and veins; because it's not affected by forces acting on the fluid and the pressure is about 100 mmHg at the ankles.
- The hydrostatic pressure at the heart is zero because blood is pumped by it, and it is negative above the heart (that is why it is rare to have venous insufficiency at the upper limbs, and it tells us that it is due to a pathology).



2- Dynamic Pressure: Formed by the forces acting on the fluid from surrounding tissues.

(THE MESSAGE IS THE PRESSURE IN LOWER LIMB IS VERY HIGH)

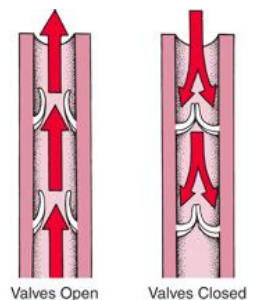
Venous Return Mechanisms:

1-Unidirectional valves

(the most effective mechanism)

Valves are single layer leaflets of endothelial cells that contain one way valves that prevent blood from flowing **backwards** (when the other 3 mechanisms temporarily stop) and only allow movement from distal to proximal and from superficial to deep.

(pathology starts when these valves don't function)

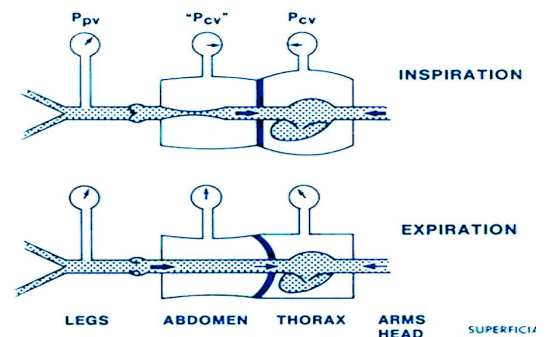


2- Respiratory pump

(the most effective mechanism)

Pressure changes induced in thoracic cavity by breathing sucks blood upward toward the heart.

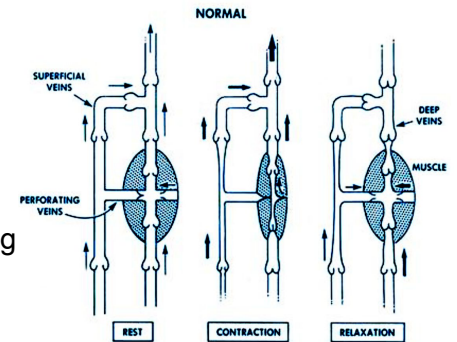
When we inhale, the pressure becomes negative in the thorax and positive in the abdomen so the blood will go from the abdomen to thorax. When we exhale, the abdominal pressure decreases and it receives blood from lower limbs.



3- Leg (calf) muscle pump

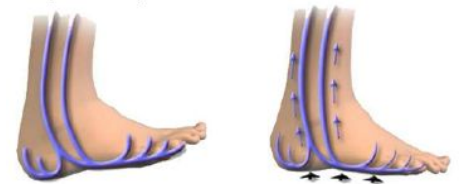
When walking each leg has a cycle of two phases:

- Pushing off leg → Contractions of muscles → propels blood towards heart
- Lifting leg → Relaxation of muscles → draws blood **from superficial to deep veins** during relaxation **valves** are responsible for preventing blood from going backwards.



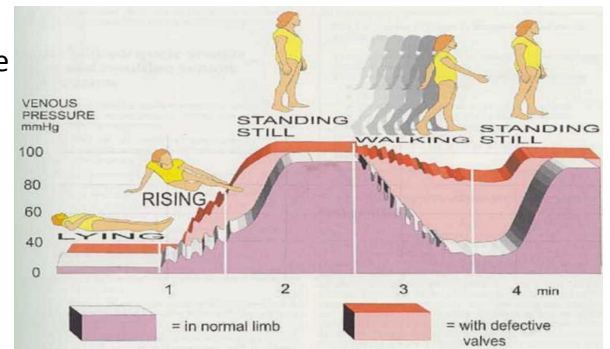
4- Foot sole & ankle pump

- Weight-bearing of feet causes veins in the sole of the foot to be compressed sending blood from the sole of foot to the calf muscles.
- The calf muscles can only function efficiently if mobility of the ankle joint is unimpeded
- Venous pressure >100 mmHg
- Contributes >50% of blood leaving calf



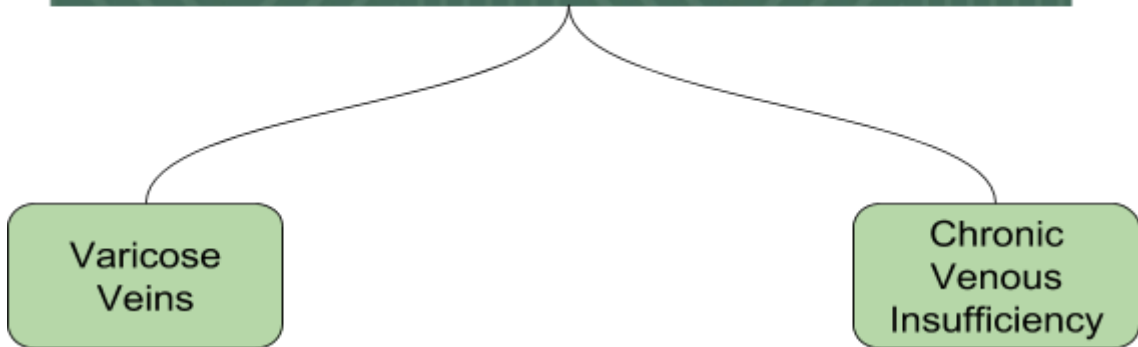
Ambulatory Venous Pressure (AVP):

- Ambulate = to walk
- It is the minimal pressure in foot veins when walking due to the mechanisms of venous return
- In supine position → AVP is around 10 mmHg
- Standing still → AVP rises to 90 mmHg
- Upon walking, it falls to 25 mmHg (7 steps = max effect)



IN REVIEW! If you understand normal you will be able to advise and guide regarding therapy for the abnormal.

Venous Disorders






I) Varicose veins

[video](#)

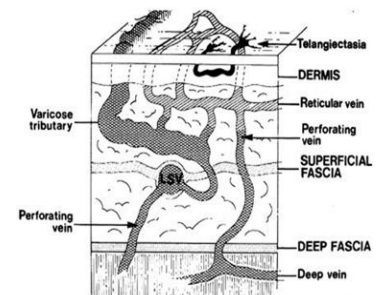


★ Most common vascular disorder

Varicose Veins Classification

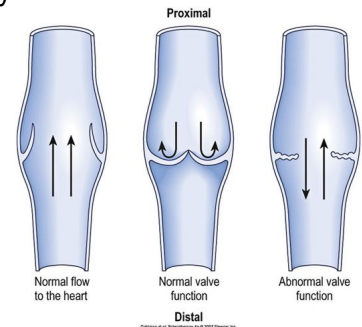
Telangiectasia	Reticular veins	Varicose veins
Confluence of dilated intradermal venules less than 1 mm in diameter 	Dilated bluish tortuous subdermal veins 1-3 mm in diameter 	subcutaneous dilated, elongated, tortuous veins greater than 3 mm involving saphenous veins, saphenous tributaries or non saphenous tributaries 

An image illustrating the layers of skin where each of the varicose veins' classifications is found. (fascia, a layer of dense connective tissue which can surround individual muscles, and also surround groups of muscles to separate into fascial compartments).



II) Chronic Venous Insufficiency (CVI)

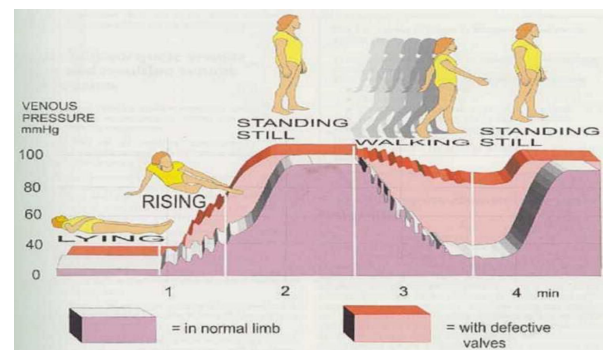
- CVI can be defined as skin damage in lower limbs as a result of **ambulatory venous hypertension**.
- CVI collectively describes the manifestations of impaired venous return mainly due to **failure of valves** that leads to continued reflux of blood.
- It may manifest as reflux **90%** or an obstruction **10%**
- The underlying causes can be classified into:
 - Primary (floppy valve): valvular incompetence for unknown reason.
 - Secondary: due to other factors that increase the load on veins (obesity, pregnancy, mass, deep vein thrombosis)
- Main defect may be in Superficial, Deep or Perforating veins
- **Increased Ambulatory Venous Pressure**



Ambulatory Venous Hypertension:

It's when the pressure in lower limbs veins does NOT sufficiently decrease after walking due to failure of venous return mechanisms. If the condition is prolonged, it will lead to **CVI**.

In the image, compare the venous pressure changes in normal limb and in the one with defective valves



Venous Ulcers

- Ulcers that develop due to venous insufficiency.
- Typically in "gaiter area" (**very characteristic** of venous ulcers). Why Gaiter's? Because this area is where refluxed blood accumulates in saphenous veins + this area doesn't have enough muscle and fat tissue that could absorb the toxic fluid leaking from veins, so it will directly attack the skin.

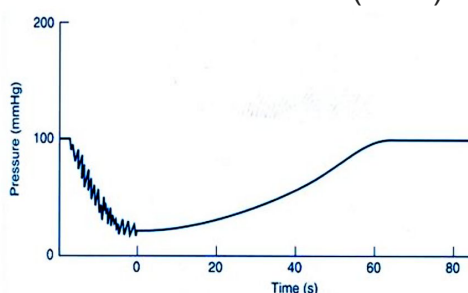
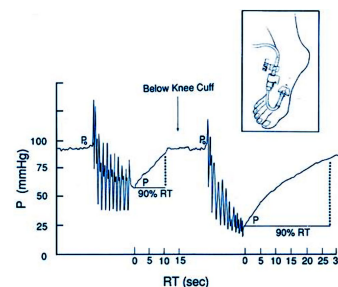


2) Invasive:

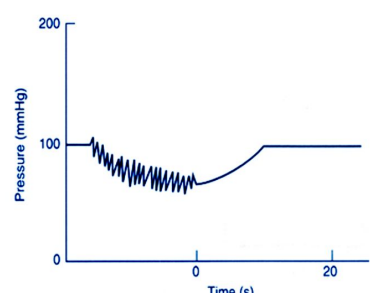
a. Ambulatory Venous Pressure (AVP):

(Experimental, Doctor said don't waste much time on this)

- 20-21 gauge Butterfly Needle
- Superficial Dorsal Vein (foot) or ankle vein
- Standing and heel raised and then we measure AVP
- Interpretation:
 - Normal: less than 80-90 mmHg to 20-30 mmHg or >50% drop. Venous Refill Time(VRT): ≥ 20 s
 - Abnormal:
 - I. Lack of sufficient drop in pressure with ambulation (<50%)
 - II. Short VRT (<20s)



Normal



Deep Venous Incompetence

b. Phlebography (Venography): it's invasive and toxic, now we don't do it to diagnose (US & Duplex used instead), it's used in therapeutic procedures.

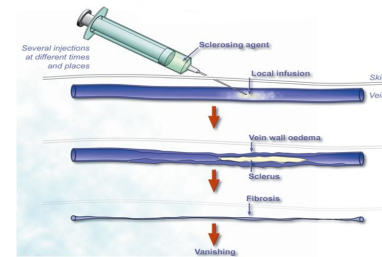
Treatment

- A. The treatment goal is to reduce the AVP in primary venous insufficiency
- B. In secondary venous insufficiency treat the underlying cause
- C. Principles of treatment:
 - a. Obstruct or remove the problematic vein (process called **ablation**) provided that there is another functioning vein draining the same area → (that's why **ablation of major superficial veins is contraindicated in DVT**). All of treatment methods are basically aiming to remove these dysfunctional veins.
 - b. Always exclude secondary causes by physical examination, history and investigations.
- D. Depending on the severity and other factors (e.g. patient ability to withstand surgery) we determine the treatment method:
 - 1- Telangiectasia and Reticular vein: Stocking and/or Sclerotherapy (Sclero-Rx)
 - 2- Varicose veins:
 - a. Stocking
 - b. UltraSound Guided Sclerotherapy (USG-Sclero-Rx)
 - c. EndoVenous Laser Therapy [EVLT] /Surgery
 - 3- Edema or Cutaneous Ulcer or Local wound:
 - a. Stocking
 - b. USG-Sclero-Rx
 - c. ELVT/Surgery

1- Sclerotherapy (chemical ablation):



- Introducing toxins to damaged veins that leads to their thrombosis first and then they go through fibrosis and closure.



- Examples of sclerotic agents on the right

<p>TROMBOJECT[®] Sodium Tetradecyl Sulfate Omg.Std. 10mg/mL 10 vials of 2mL 30mg/mL 10 vials of 2mL 30mg/mL 10 vials of 5mL</p>	<p>SALIJECT[®] Sodium Salicylate Omg.Std. 5.7g/10mL (570mg/mL)</p>
<p>SCLERODEX[®] 5 vials of 10 mL Dextrose USP 250mg/mL Sodium Chloride USP 100mg/mL</p>	<p>SCLERODINE[®] 6 Iodine 600mg/10mL (60mg/mL) Sodium Iodine 900mg/10mL (90mg/mL)</p>

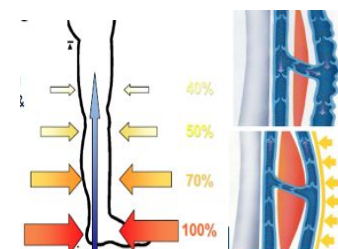
- Sclerotherapy complications: Doctor said that you shouldn't waste your time on it

Solution	Pigmentation	Allergic reaction	Necrosis	Pain
Sodium morrhuate	++	++	+++*	++
Sodium tetradecyl sulfate	++	+	+++*	+
Ethanolamine oleate	+	++	+++*	++
Polidocanol	+	+	+++*	0
Hypertonic saline	+	0	+++*	+++
Sclerodex(10% saline + 5% dextrose)	+	0	+	++
Chromated glycerin	0	+	0	++
Polyiodinated iodine	++	+	+++*	+++

+, Minimal; ++, moderate; +++, significant.
*Concentration dependent.

2- Compression therapy (mechanical ablation):

- Stockings that compresses on legs with high pressure.
- Hemodynamic Effect:
Compress the superficial veins to make sure that blood doesn't go through them.
- Difficulties:
 - Temporary solution: whenever the patient takes them off their effect is lost
 - Compliance (uncomfortable)**



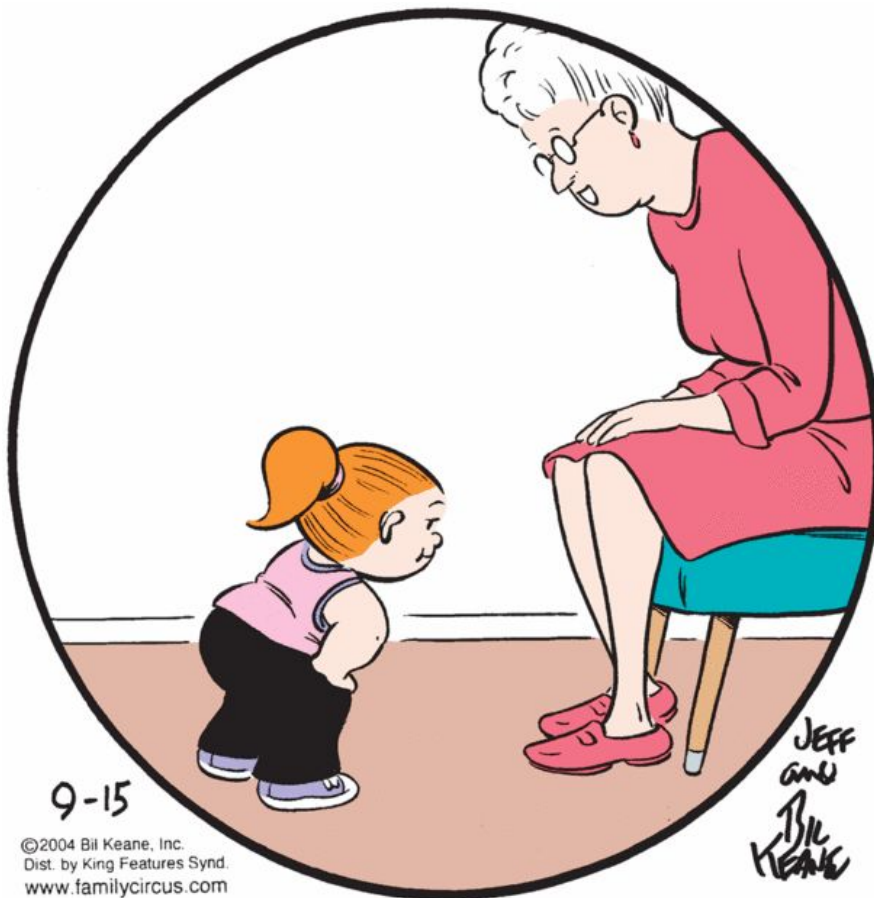
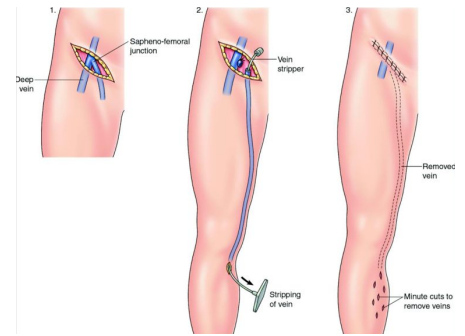
3- EndoVenous Laser Therapy [EVLT] (Thermal ablation):

- Catheter with that can beam laser at its end that heats and destroys veins from inside which leads to thrombosis and finally fibrosis.
- Process: Denaturation of vein wall collagen → Contraction → Fibrous Obliteration
- Thermal ablation could also be done through radio frequency (Heat-producing Ultrasound)



4- Surgery: (Surgical ablation)

An old method of stripping the vein.



“Thank you, Dolly, but they’re not tattoos. They’re varicose veins.”