## VENOUS DRAINAGE OF THE LOWER LIMB INTRODUCTION

The venous drainage of the lower limb is of immense clinical and surgical importance. The venous blood of the lower limb is drained against gravity. However, number of factors helps to facilitate its drainage. If these factors fail to help the drainage, the stagnation of venous blood in the superficial veins cause varicose veins and in the deep veins leads to deep vein thrombosis.

### Factors Helping the Venous Drainage of the Lower Limb

1. The contraction of the calf muscles (chief factor) squeezes the blood upward along the deep veins. Note the calf muscles act as 'calf pump (peripheral heart)'.

2. Transmitted pulsations from the adjacent arteries.

3. Presence of valves in the perforating veins prevents the reflux of blood into the superficial veins during contraction of the calf muscles.

4. Presence of valves in the deep veins supports the column of blood and maintains unidirectional upward flow of the blood.

5. Negative intrathoracic pressure becomes more negative during inspiration and yawning.

6. In recumbent position,' is produced by the contraction of the heart and suction action of the diaphragm.

## CLASSIFICATION OF THE VEINS

The veins of the lower limb are classified anatomically and functionally into the following three types:

1. Superficial veins.

2. Deep veins.

3. Perforating veins.

**The superficial veins** essentially include the great and small saphenous veins, They lie in the superficial fascia on the surface of the deep fascia and are thick walled because of the presence of the smooth muscle. They possess valves, which are more numerous in their distal part than in the proximal part. A large proportion of their blood is drained into the deep veins through the perforating veins.

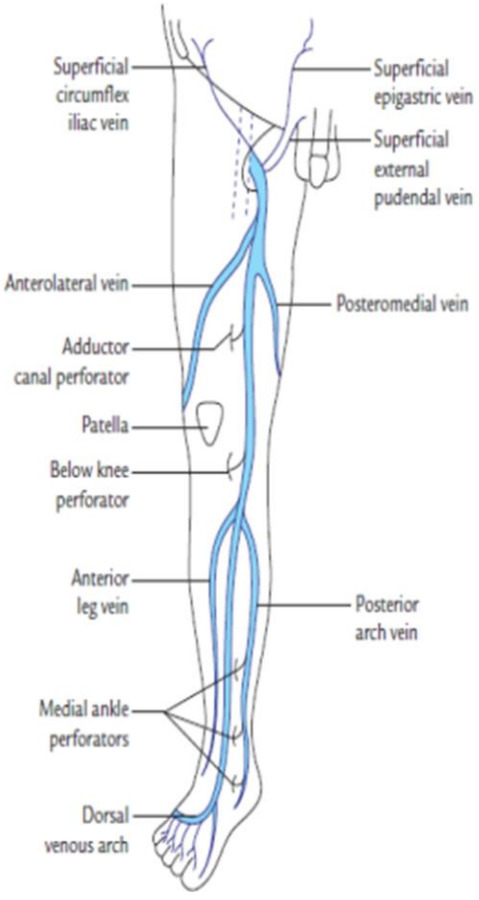
**The deep veins** include the anterior tibial, posterior tibial, peroneal, popliteal, and femoral veins. They are surrounded and supported by the powerful muscles. They possess more valves. They accompany the arteries. Below the knee, they are arranged as a pair of venae comitantes along the arteries but above the knee, they form single large vein. All the veins from muscles draining into deep veins also possess valves except those in the soleus where they are arranged in the form of venous sinuses (soleal sinuses).

**The perforating veins (perforators)** connect the superficial veins with the deep veins and pierce the deep fascia. Their valves permit only one-way flow of the blood, from the superficial veins to the deep veins. There are about five perforators along the great saphenous vein, and one perforator along the small saphenous vein.

SUPERFICIAL VEINS / GREAT SAPHENOUS VEIN

The great saphenous vein lies in the superficial fascia and is easily seen (Greek saphenous_easily seen). The great saphenous vein is the longest vein of the body and represents the pre-axial vein of the lower limb. It is also called long saphenous vein. Course It is formed on the dorsum of foot by the union of the medial end of the dorsal venous arch of the foot and medial marginal vein of the foot.

The vein runs upward about 2.5 cm in front of the medial malleolus, crosses obliquely the medial surface of the lower third of tibia, and



then ascends a little behind the medial border of tibia to reach the knee, where lies the posteromedial aspect of the knee joint, about one handbreadth posterior to the patella; from here it runs upward along the medial side of the thigh to reach the saphenous opening (fossa ovalis). It passes through the saphenous opening after piercing the cribriform fascia and drains into the femoral vein after piercing the femoral sheath.

**Tributaries**

1. A**t the commencement**: Medial marginal vein of the big toe.

2. **in the leg**: (a) Communicating veins with small saphenous and deep veins. (b) Posterior arch vein. It is fairly large and constant. It collects the blood from the posteromedial aspect of the calf and begins of a series of small venous arches connecting the three medial ankle-perforating veins (perforators).

3. **Just below the knee**: (a) Anterior veins of the leg. They extend diagonally (upward, forward, and medially) across the shin and join the great saphenous vein. (b) A vein from the calf which communicate with the small saphenous vein.

4. **In the thigh**: (a) Anterolateral vein. It commences in the lower part of the front of thigh, crosses the apex of femoral triangle, and joins the great saphenous vein in the upper part of the thigh. (b) Posteromedial vein (accessory saphenous vein). It commences from the posteromedial aspects of the thigh and joins with the great saphenous vein; sometimes it may communicate below with the small saphenous vein.

5. **Just before piercing the cribriform fascia**: (a) Superficial epigastric vein. (b) Superficial circumflex iliac vein. (c) Superficial external pudendal vein. These veins accompany the corresponding superficial branches of the femoral artery.

6. **Just before the termination in the femoral vein**: Deep external pudendal vein (last tributary) drains the blood from the anterior part of the perineum.

## Valves in the Great Saphenous Vein

There are about 10 to 20 valves in the great saphenous vein, out of which the location of two needs special mention here: (a) one, which lies just before it pierces the cribriform fascia and (b) the other, which lies at its junction with the femoral vein (saphenofemoral valve), It is of great functional significance. It lies about 3.5 to 4 cm inferolateral to the pubic tubercle. In about 80% individuals, the external iliac vein possesses a valve, which protects the saphenofemoral valve against high venous pressure. In remaining 20% cases who do not have this valve become the victim of high venous pressure and develop varicose vein, which commences at the saphenofemoral junction and gradually extends downward.

## Surface Marking of the Great Saphenous Vein

1. **At ankle,** it lies 2.5 cm anterior to the medial malleolus.

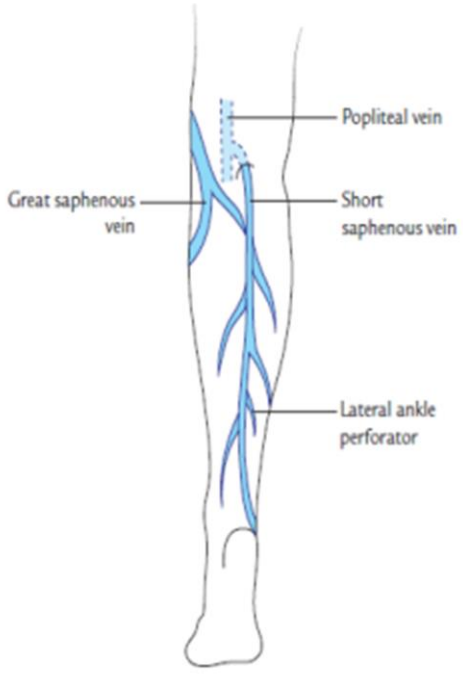
2. **In leg,** it ascends by crossing the medial surface and medial border of the tibia.

3. **At knee,** it lies about a hand's breadth posterior to the medial margin of the patella.

4. **In thigh**, it ascends obliquely on the medial aspect of the thigh to reach a point 3.5–4 cm inferolateral to the pubic tubercle (saphenofemoral junction).

## SMALL (SHORT) SAPHENOUS VEIN

It is formed below and behind the lateral malleolus by the union of the lateral end of the dorsal venous arch, and the lateral marginal vein of the foot. It runs upward behind the lateral malleolus, along the lateral edge of tendocalcaneus, and is accompanied by the sural nerve on its lateral side. Thereafter it runs in the middle of the back of the leg, pierces the deep fascia, and undergoes a subfascial course between the two heads of the gastrocnemius until it



reaches the middle of the popliteal fossa. Here it turns inward to terminate into the popliteal vein. The posterior femoral cutaneous nerve accompanies the upper part of the vein, while passing from deep to superficial. The small saphenous vein contains 7–13 valves.

**PERFORATING VEINS (PERFORATORS)**

As described earlier they are communicating venous channels between the superficial and deep veins. These veins are called perforators because they perforate the deep fascia. The perforators are classified into two types: indirect and direct

1. **Indirect perforators**: They connect the superficial veins with the deep veins through muscular veins.

2. **Direct perforators**: They connect the superficial veins with the deep veins directly.

Location of Perforators

**The position of five or six perforators is fairly constant, as mentioned below**

1. An adductor canal (mid-Hunter) perforator: It connects the great saphenous vein with the femoral vein in the lower part of the adductor (Hunter's) canal.

2. A knee perforator (Boyd's perforator): It connects the great saphenous vein with the posterior tibial vein just below the knee and close to the medial border of tibia.

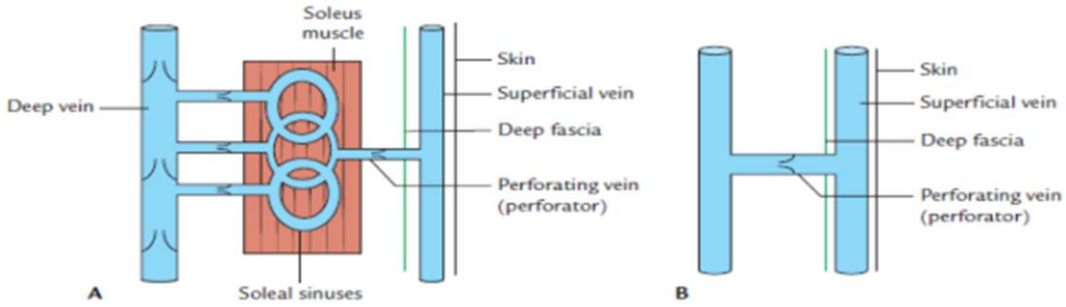
3. A lateral ankle perforator: It communicates the short saphenous vein with the peroneal vein. It is situated at the junction of middle and lower third of the leg.

4. Three medial ankle perforators (of Cockett): These are situated close to the medial border of the lower third of tibia between the medial malleolus and mid-calf and connect the great saphenous vein with the posterior tibial veins.

(a) Upper medial ankle perforator: It lies at the junction of the middle and lower third of the leg.

(b) Middle medial ankle perforator: It lies about 4cm above the medial malleolus.

(c) Lower medial ankle perforator: It lies posteroinferior to the medial malleolus.




**Clinical note:** Calf pump and peripheral heart: In upright position, the venous return from the lower limb against gravity depends largely on the contraction of calf muscles. Therefore, these muscles are termed calf pump. The soleus muscle contains venous sinuses filled with blood. When soleus muscle contracts, it pumps the blood from its large venous sinuses into the deep veins, and when it is relaxed it sucks the blood from the superficial veins, and the venous sinuses within it are refilled. The unidirectional blood flow is maintained by the valves in the perforating veins. Hence, the soleus is sometimes termed peripheral heart. The soleal sinuses are common site for thrombosis and source of pulmonary embolism in sedentary individuals. The phlebitis of soleal sinus may be dangerous because the spread of infection from here may damage the valves in the perforators.