INTRODUCTION

Leg ulcer defined as a break in the skin of the lower leg, which takes more than 4-6 weeks to heal ***(Callam MJ, 1999).***

Venous ulceration accounts for 70 to 80% of lower limb ulceration, ischemic arterial ulcers, rheumatologic disorders, local atrophic effects, unrecognized cancer and other more exotic causes constitute the balance ***(Luciana P et al., 2005)***.

Chronic venous leg ulcers are a major source of morbidity, especially in the elderly. Quality of life is reduced because of the associated pain, odour and appearance of these wounds. Chronic venous insufficiency can vary from being mild to severe and can be associated with ulceration and its attendant morbidity and mortality. Slightly more than 2% of men and 4% of women with CVI will develop ulceration ***(Reichenberg J and Davis M, 2005)***.

Epidemiologic estimates as to the prevalence of venous ulcers in the general population vary greatly, ranging from 0.3 to 2%.The incidence of venous ulcerations also varies greatly ***(Nelzen O et al., 1994)***.

Much like all ulcers, venous ulcers seem to have an increased rate in older age groups, with a peak between 60 to 80 years of age. Venous ulcers often are persistent: 34% of patients with venous ulcers had their ulcers for more than 5

years and a recurrence rate has been estimated to be as high as 72% ***(Reichenberg J and Davis M, 2005)***.

The management of chronic venous leg ulcers includes compression bandaging, moisture management dressings, debridement of slough and necrotic tissue, application of wound cleansers and topical agents and secondary therapies such as vacuum-assisted closure ***(Johnson S, 2002)***.

AIM OF THE WORK

This work aims at discussing the diagnosis and treatment of chronic venous leg ulcers including the updates in medical and surgical modalities.

Chapter One
ANATOMY OF THE LOWER LIMB VENOUS SYSTEM

The venous system of the lower limb consists of superficial and deep veins

(I) The superficial veins of the leg

The superficial veins lie in the superficial fascia. The principal named superficial veins are the long and short saphenous veins ***(Strandring S, 2005)***.

- ***The long saphenous vein***

The long saphenous vein (saphena magna vein) is the longest vein in the body. It is formed by the union of veins from the medial side of the sole of the foot with the medial dorsal veins. It runs upwards in front of the medial malleolus (lying in the groove between the anterior border of the medial malleolus and the tendon of tibialis anterior) along the length of the antro-medial aspect of the lower limb, gradually inclining posteriorly to pass behind the medial condyles of the tibia and femur. From here it climbs slightly forwards upon the antero-medial aspect of the thigh and into the saphenous opening to join the common femoral vein 3cm below the midpoint of the inguinal ligament. It is accompanied by the saphenous branch of the femoral nerve ***(Browse NL et al., 1999)***.

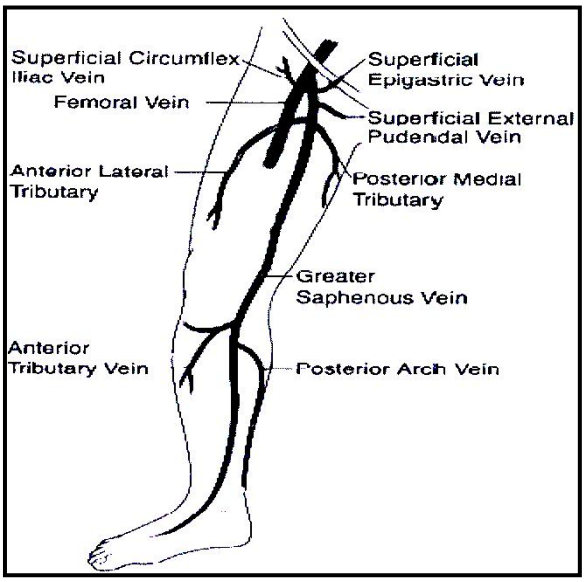

Figure (1): Long saphenous vein with its tributaries ***(Min RJ et al., 2003)***.

Tributaries:

The long saphenous vein receives several tributaries in its course. The medial superficial veins from the sole join it near its anatomical origin ***(Browse NL et al., 1999).*** The major tributary is the posterior arch vein, which is connected to the deep venous system by three major medial ankle-perforating veins (three Cockett's perforating veins). The anterior tributary vein connected to the saphenous system below the patella and collects blood from the anterior and lateral surface of the leg. The posterior tributary vein, empties into the great saphenous vein in the upper anterio-medial calf ***(Bergan JJ, 2005)***.

Two large tributaries join the long saphenous vein in the thigh. They are probably best referred to as the postero-medial and antero-lateral superficial veins of the thigh.

In the groin, the great saphenous vein receives a number of tributaries draining the lower anterior and lateral abdominal wall and perineum. The constant named branches are the superficial circumflex iliac, superficial epigastric and superficial external pudendal veins ***(Sinnatarnby CS, 1999)***.

- ***The short saphenous vein***

The short sapherous vein, draining the lateral side of the dorsal venous arch and the lateral margin of the foot, lies with the sural nerve behind the lateral malleolus ***(Sinnatamby CS, 1999)***.

It passes along the lateral border of the calcaneal tendon then inclines to the midline of the fibula and penetrates the deep fascia and enters the popliteal vein between the heads of the gastrocnemius muscle ***(Moore KL and Dailey AF, 2006)***.

There are a number of variable connections between the long and short saphenous vein in the region of the knee and these may cause confusion when trying to decide whether varices are connected to dorsal tributaries of the long saphenous vein or to tribuataries of the short saphenous vein ***(Browse NL et al., 1999)***.

Approximately 60% of all short saphenous veins join the popliteal vein in the popliteal fossa within 8cm of the knee joint; 20% join the long saphenous vein via the postero-medial or antero-lateral superficial thigh veins at varying levels in the

thigh; and the remainder join the superficial femoral vein, deep femoral vein, or even tributaries of internal iliac veins ***(Browse NL et al., 1999)***.

Tributaries:

The small saphenous vein communicates with the deep veins on the dorsum of the foot, receives numerous cutaneous tributaries from the back of the leg, and sends several branches upwards and medially to join the great saphenous vein ***(Strandring S, 2005)***.

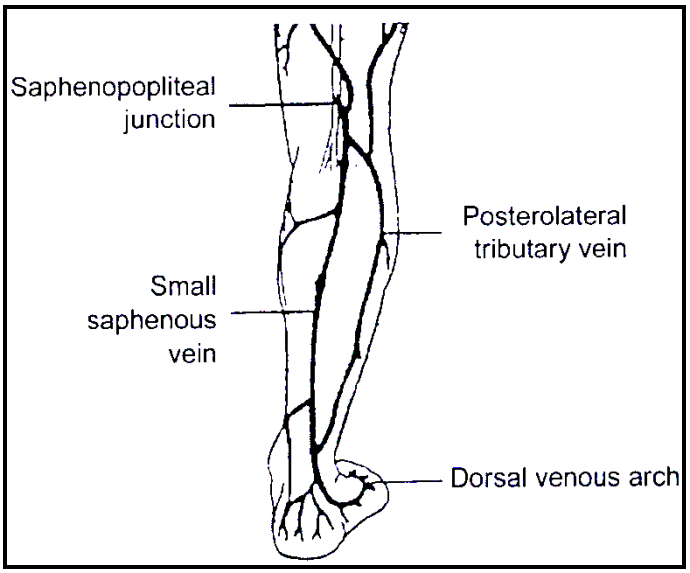

Figure (2): Course and tributaries of small saphenous vein. The site of termination is extremely variable although usually the vessel terminates in the popliteal fossa ***(Bergan JJ, 2005)*.**

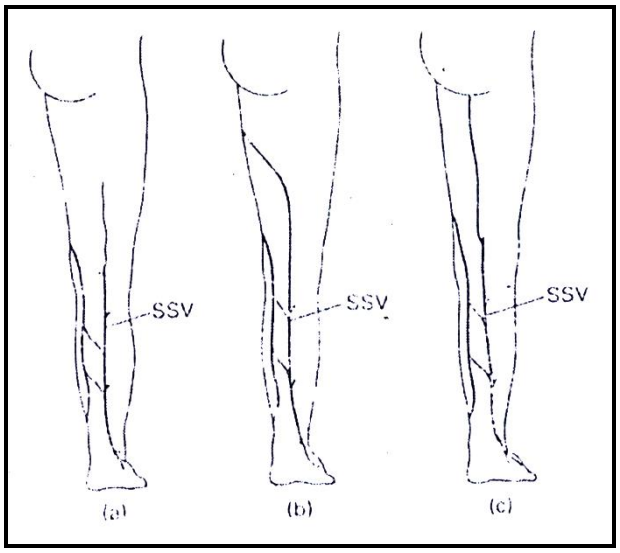

Figure (3): Diagrams of the variations in termination of the short saphenous vein (SSV). (a) A small tributary extending superficially onto the back of the thigh. (b) The short saphenous vein joining the superficial postero-medial vein of the thigh which drains into the long saphenous vein. (c) The short saphenous vein passing deeply to join a gluteal vein draining into the internal iliac ***(Browse NL et al., 1999)***.

(II) The deep veins of the leg

The deep veins of the lower leg consist of three paired stem veins, which are venae commitantes, accompanying the arteries: the anterior tibial veins; the posterior tibial veins and the peroneal veins. Each vein may divide into several trunks, which surround the artery and anastomose freely with each other ***(Browse NL et al., 1999)***.

- ***The anterior tibial venae comites:***

These are the continuation of the dorsalis pedis veins. They run upwards between the tibia and fibula lying on the

interosseous membrane anteriorly, closely overlaid by the anterior tibial group of muscles. At the upper fourth of the leg, they turn posteriorly over the upper edge of the interosseous membrane close to the neck of the fibula ***(Strandring S, 2005)***.

- ***The posterior tibial venae comites:***

The medial and lateral plantar veins unite behind the medial malleolus to form the posterior tibial venae comites. These veins run upwards beside the posterior tibial artery and nerve ***(Strandring S, 2005)***.

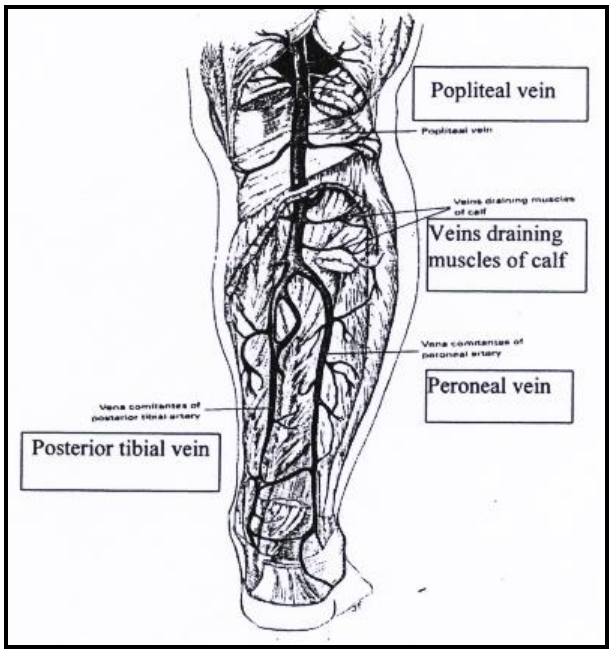

Figure (4): Deep venous circulation of the posterior portion of the leg ***(Sinnatamby CS, 1999)***.

- ***The peroneal venae comites:***

The peroneal veins lie directly behind and medial to the fibula. They run with peroneal artery, receive branches from soleus and superficial veins ***(Strandring S, 2005).***

The anterior, posterior tibial, peroneal vena comites, the gastrocnemius veins and the soleus venous arcades join to form the popliteal vein, which receives the short saphenous vein. The popliteal vein becomes the superficial femoral vein in the lower thigh where the profunda femoris vein joins it to form the common femoral vein, which receives the termination of the long saphenous vein ***(Negus D, 1995).***

- ***Venous drainage of soleus and gastrocnemius muscles:***

The veins of the calf muscles are large, baggy and valveless, the so-called sinusoidal veins that are dilated segments of the venous arcades joining the posterior tibial and peroneal veins, or thin and straight with valves. The former predominate in the soleal muscle and the latter in the gastrocnemius muscles ***(Browse NL et al., 1999)***.

In the upper part of the calf, the paired stem veins emerge from the medial and lateral heads of the gastrocnemius then unite at different levels to form the popliteal vein. The veins from the solues muscle drain into the stem veins or the lower part of the popliteal vein. The veins from the

gastrocnemius muscles drain into the lower and upper parts of the popliteal veins ***(Browse NL et al., 1999)***.

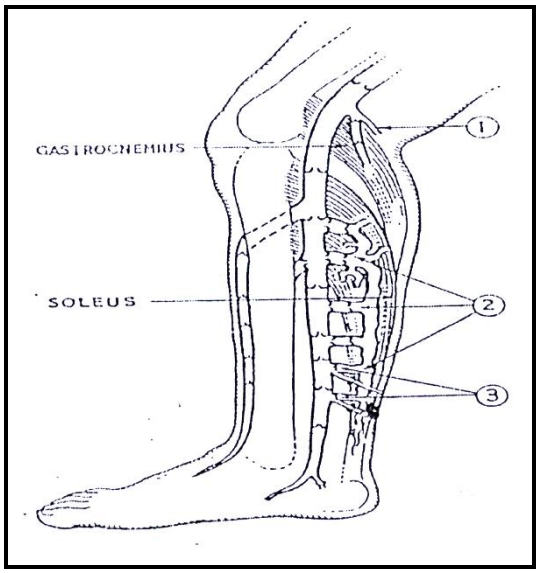

Figure (5): Diagram of deep veins of leg. 1. Origin of gastrocnemial veins. 2. Venous sinuses in soleus. 3. Origin of upper and middle inner ankle perforating veins ***(Negus D, 1995)***.

(III) The perforating veins

The perforating veins penetrate the deep fascia close to their origin from the superficial veins and contain valves that allow blood flow only from the superficial veins to the deep veins. Anatomically there are two types-direct and indirect. The direct perforators pass directly from the superficial veins to the deep veins and the indirect interrupt their course into muscular venous channels before terminating in the deep veins ***(Moore KL and Dailey AF, 2006)***.

- ***Great saphenous perforators***

The termination of the great saphenous vein satisfies the criteria of a perforating vein and as such can be considered the major direct perforating vein in the lower limb. There is one other relatively constant perforating vein in the thigh which is located approximately 15cm proximal to the level of the knee joint along the line of the great saphenous vein. This is one of the few perforating veins, which establish direct communication between the great saphenous vein and the deep system of veins. From this site it perforates the deep fascia to join the superficial femoral vein in the sub-satorial canal ***(Sinnatamby CS, 1999)***.

There are a series of about six medial calf perforators that join the posterior tibial vein to the great saphenous vein through the posterior arch vein ***(Rutherford RB, 2005)***.

There is usually one about 10 cm above the medial malleolus and another one a little below the middle of the leg. Higher up, there is a perforator just distal to the knee ***(Sinnatamby CS, 1999)***.

- ***Short saphenous perforators***

The most important communicating vein on the lateral side of the lower leg is not constant in position. It connects the short saphenous vein with the peroneal veins anywhere from just above the lateral malleolus to the junction of the lower and

middle thirds of the calf. Two more constant communicating veins also joining the short saphenous vein with the peroneal veins are situated posterior approximately 5cm and 12cm above the oscalcis. There are two posterior mid-calf communicating veins, which sometimes cause recurrent varicose veins. They join the short saphenous vein or its tributaries to the soleal or gastrocnemius muscle veins near the midline and are referred to as the soleal and gastrocnemius points ***(Browse NL et al., 1999)***.

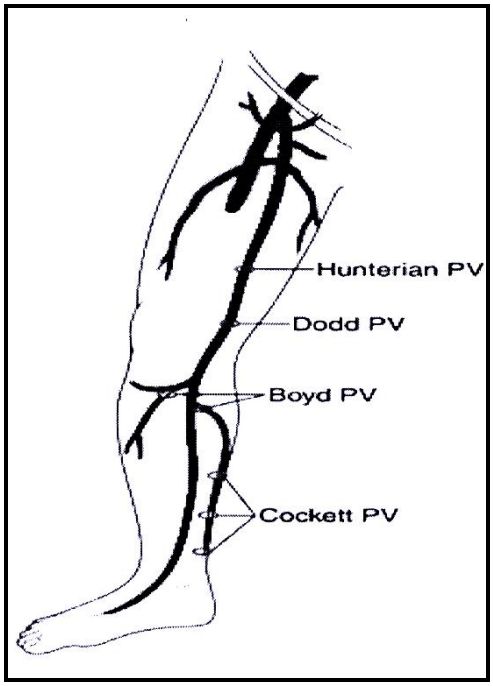

Figure (6): The location of the most important perforating veins associated with the great saphenous system is shown ***(Min RJ et al., 2003)***.

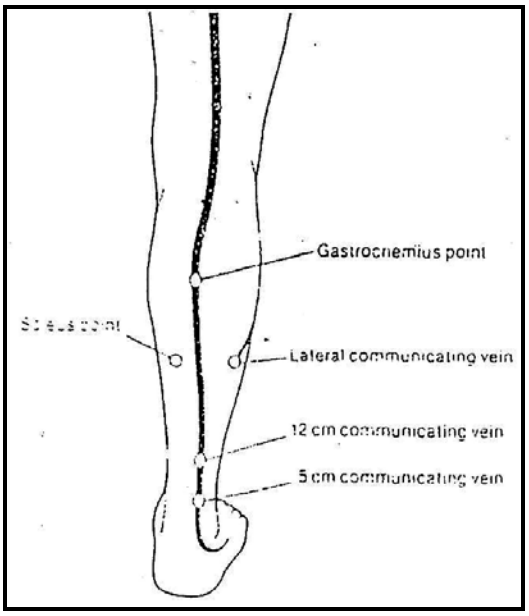

Figure (7): Short saphenous perforators ***(Browse NL et al., 1999)***.

(IV) Valves:

Most veins contain bicuspid valves, which direct flow proximally and from the superficial to the deep veins. Valves consist of collagen fibers covered by a thin layer of endothelium and are stronger than the vein wall ***(Negus D, 1995)***.

There are no valves in the superior and inferior vena cava (they have some in early developmental stages) but there are valves in the tributaries from both the upper and lower limbs, the number of valves increasing towards the periphery of each limb. Valves do not appear to play an important part in controlling the circulation within the upper limbs but the valves in the lower limbs play an important role in controlling the direction of blood flow ***(Browse NL et al., 1999)***.

- ***The valves of the superficial veins:***

The great saphenous vein contains up to twenty valves, more of them lay blow knee level than above ***(Sinnatamby CS, 1999)***.

The small saphenous vein possesses from seven to thirteen valves, one near its termination in the popliteal vein ***(Strandring S, 2005)***.

- ***The valves of the deep veins:***

There are no valves in the sinusoidal veins of the soleal muscles but the venous arcades, which drain the soleal and gastrocnemius muscles have numerous valves.

All the deep veins of the calf are densely valved, the valves being situated at approximately 2cm intervals. The popliteal vein usually has 2 valves in the region of the knee joints; damage of these valves may have serious consequences on the calf muscle pump.

The valves in the communicating veins between the superficial and deep venous systems of the leg are arranged, so that blood flows from the superficial to the deep veins, and the high pressure in the deep venous system is prevented from reaching the superficial veins ***(Browse NL et al., 1999)***.