

Venous disorders

Introduction

Venous disorders are very common and especially affect the lower limb. Twenty per cent of the population suffer with varicose veins and 2 per cent have skin changes which may precede venous ulceration.

Anatomy of the venous system in the limbs

Arterial blood flows through the main axial arteries to the upper and lower limbs. It returns via the deep and superficial veins. In the upper limb the superficial veins are more important in carrying blood back to the heart. In the lower limb, the superficial veins carry only about 10 per cent of the blood, while the remainder passes via the deep veins. The superficial veins lie superficial to the muscle fascia of the limb. The principal superficial veins in the leg are the long and short saphenous veins. In the arm, the cephalic and basilic veins are the principal superficial veins.

Interestingly, venous diseases occur much more frequently in the lower limb than in the upper limb, and most often in the superficial veins. The deep veins of the lower limb may be the site of life threatening venous thrombosis or venous valvular incompetence resulting in leg ulceration. The superficial and deep veins join at a number of points. The short saphenous vein terminates at the saphenopopliteal junction (SPJ) and the long saphenous vein at the saphenofemoral junction (SFJ) in the groin. Here the flow in the superficial veins joins that in the deep veins. There are, in addition, a number of places in the calf and thigh where flow in the superficial veins may also join that in the deep veins. These are the ankle, calf and thigh communicating or perforating veins

Venous pathophysiology

- ❖ Blood flows into the leg because it is pumped by the heart along the arteries.
- ❖ By the time it emerges from the capillaries it is at a low pressure (about 20 mmHg), but this is enough for the blood to return to the heart.
- ❖ Valves prevent the flow of blood from the deep to the superficial system.
- ❖ The venous pressure in the foot vein on standing is equivalent to the height of a column of blood, extending from the heart to the foot. However, the same is true of the arterial system so that on standing the arterial blood pressure at the ankle rises by 80—100 mmHg, depending on the height of the person. So the blood continues to circulate, even in the absence of muscle activity.
- ❖ We also have a sophisticated series of muscle pumps that act as peripheral hearts in the venous system.
- ❖ The direction of venous blood flow is controlled by the venous valves. The pressure within the calf compartment rises to 200—300 mmHg during walking and this is more than enough to propel the blood in the direction of the heart. During the muscle relaxation phase, the pressure within the calf falls to a low level and blood from the superficial veins flows through the perforating veins into the deep

veins. The consequence of this is that the pressure in the superficial veins falls during walking.

- ❖ Normally the pressure in the superficial veins of the foot and ankle falls from a resting level of 80—100 mmHg to about 20 mmHg. This ability to reduce the pressure in the superficial venous system is crucial to the health of the lower limb. Patients with damage to the veins in whom the superficial venous pressure does not fall during exercise may develop varicose eczema, skin damage and, eventually, leg ulceration.

Venous Incompetence - varicose Veins

One of the most common problems with the veins of the leg is failure of their valves. This occurs frequently in the superficial venous system resulting in varicose veins.

The mechanisms that cause the superficial vein valves to fail have not been fully established. What appears to happen is that first a small gap appears between the valve cusps at the commissure (where the valve leaflets join the vein wall). This gap widens and more reverse flow (venous reflux) is allowed. The valve cusps degenerate and holes develop in them. Eventually they disappear completely. The vein below the valve responds by dilating. Varicose veins may eventually reach five times their usual size if left to develop for long enough.

Varicose veins are thought to develop more often in people who stand during their work. They often develop during pregnancy under the influence of oestrogen and progesterone which cause the smooth muscle in the vein wall to relax.

Clinical features

They may either give no symptoms or cause aching and discomfort in the legs. Varices are recognised as tortuous dilated veins in the leg, but physiologically speaking a varicose vein is one which permits reverse flow through its faulty valves. Patients may develop much smaller varices. These range from 0.5-mm diameter vessels in the skin, which are commonly referred to as thread veins or dermal flares, and are usually purple or red in colour.

Cosmetic appearance is unsatisfactory. Patients may also report aching especially on standing, itching, 'restless legs' and ankle swelling. The severity of the symptoms is unrelated to the size of the veins, and is often more severe during the early stages of development of varices.

Complications of varicose veins

- 1) Thrombosis, which is referred to as superficial thrombophlebitis. Usually this remains in the superficial veins and may cause considerable discomfort.
- 2) Spectacular haemorrhage can occur when large superficial varices are damaged. This is easily controlled by lying the patient down, elevating the leg and applying a compression bandage.
- 3) The most serious problem is venous ulceration which complicates varicose veins.

Venous incompetence — deep vein incompetence

Valvular incompetence of the deep veins may develop in the same way as in the superficial venous system, with the degeneration of the valve cusps resulting in reverse flow in these veins. In other patients it may develop following a deep vein thrombosis. In the leg the long and short saphenous veins may act as collateral channels and may double in size to accommodate the additional blood flow. In patients with chronic iliac vein occlusion large suprapubic or abdominal varices may be seen carrying the collateral flow.

Clinical features of deep vein incompetence

- 1) The calf muscle increases in size, apparently in response to the greater work in returning blood from the leg.
- 2) There may be some ankle oedema
- 3) A proportion of patients develops skin complications. These may range from mild eczema to severe ulceration.
- 4) An early sign of skin injury is brown pigmentation due to haemosiderin deposition in the skin. This occurs because the high venous pressures cause red blood cells to be forced out of capillaries in the skin where their haemoglobin breaks down to form haemosiderin.
- 5) A later and more serious stage is lipodermatosclerosis in which palpable induration develops in the skin and subcutaneous tissues.
- 6) Atrophie blanche may also develop. In this condition the superficial blood vessels are lost from the skin and white patches develop. These indicate that the skin has been severely damaged by the venous valvular incompetence. Venous ulceration may develop in these areas.

Investigation of venous disease

- ☒ A full history should always be taken, enquiring about any injury to the leg or swelling which may suggest a previous episode of deep vein thrombosis.
- ☒ Symptoms associated with venous disease. These include tiredness, aching, tingling and ankle swelling which get progressively worse towards the end of the day and are relieved by elevating the leg. Sometimes patients report cramps in the legs, which are usually worse at night.
- ☒ Skin changes.
- ☒ A clinical examination carried out with the patient standing will reveal the extent of any varicose veins and whether they are associated with the long or short saphenous systems. Further information may be gained by using a tourniquet test to determine the source of varices. The patient lies and the leg is elevated to empty the veins. The tourniquet is applied high on the thigh and the patient stands again. The speed at which the varices fill is observed. In the case of varices from the long saphenous vein these fill within a few seconds without a tourniquet, but with the trunk of the long saphenous vein compressed in the thigh much slower filling takes place over 15 or 20 seconds. If filling is not controlled by an above-knee tourniquet, then a tourniquet is applied to compress the short saphenous vein, just below the knee. If the varices now fill

slowly then the source of venous reflux is from the SPJ. If the varices continue to fill rapidly some further source must be the cause. The patient may have incompetent deep veins or a calf perforating vein.

☒ The clinical examination should continue by noting the presence and extent of any skin changes or ulceration at the ankle. An examination of the peripheral pulses should be carried out. Venous and arterial disease of the lower limb often coexist, especially in more elderly patients. An abdominal examination completes the clinical examination in patients presenting with lower limb varices, as these may occasionally be the result of an abdominal neoplasm causing venous obstruction.

☒ Doppler ultrasound assessment is now the minimum level of investigation required before treating somebody with venous disease. A Doppler flow probe can be used to exclude arterial disease and to determine the patency of a vein, and a bidirectional flow probe used to detect venous reflux.

☒ Photoplethysmography and other plethysmographic techniques

In this investigation a probe is attached to the skin to assess venous filling of the surface venules by measuring light transmission of the skin. The filling of these vessels reflects the pressure in the superficial veins of the leg.

☒ Duplex ultrasound imaging involves the use of high-resolution B-mode ultrasound imaging and Doppler ultrasound to obtain images of veins and simultaneously measure flow in these vessels. It allows direct visualisation of the veins and provides functional, as well as anatomical, information. Modern duplex ultrasound machines represent blood flow as a colour map.

☒ Venography

This investigation is the X-ray equivalent of duplex ultrasonography. An ascending venogram is performed by cannulating a vein in the foot in order to inject X-ray contrast medium. A narrow tourniquet is applied just above the malleoli to direct blood flow into the deep veins and an injection of nonionic contrast material given to outline the veins. The technique provides excellent anatomical information but gives much less information about the veins where the valves have failed. It is a useful examination for suspected deep vein thrombosis where ultrasonography is not available.

Incompetent veins can be shown by descending venography. Here a cannula is inserted in the femoral vein and contrast material injected with the patient standing. The contrast material is heavier than blood and flows down the limb though incompetent valves.

Treatment of patients with varicose veins

This may include:

- 1) Reassurance,
- 2) The use of elastic compression stockings, injection sclerotherapy or surgical treatment.

The treatment of choice depends on the size of the varices, their extent and the symptoms that they produce.

Compression stockings

Light compression stockings may be helpful in the early stages of varicose veins but do not prevent the development of more varices or result in the disappearance of veins.

Injection sclerotherapy

This treatment is best used in the management of small varices and those where the main long and short saphenous veins, and their major tributaries, are competent. The basis of sclerotherapy is that a solution which destroys the endothelial lining of the veins is injected. The aim is to produce sclerosis with the vein being replaced by a fibrous cord, incapable of recanalisation and recurrence.

Surgical treatment of varicose veins

Surgical treatment of varicose veins is widely used and is effective in removing varicose veins of the main saphenous trunks, as well as their tributaries, down to a size of about 3 mm. Veins smaller than this are best treated by sclero-therapy. Surgical removal of varices is inappropriate where these form a major part of the venous drainage of the limb, for example where a deep vein thrombosis has destroyed the main axial limb veins and the patient relies on the superficial veins. This possibility may be suggested by the patient's medical history and can be confirmed by duplex ultrasonography or venography.

Compression bandaging is applied to the limb at the end of the operation to prevent excessive bruising.

Complications of varicose vein surgery include bruising and discomfort especially where the veins were of very large diameter. Sensory nerve injury is seen occasionally after removal of varicose veins. The saphenous nerve and its branches accompany the long saphenous vein in the calf; the sural nerve accompanies the short saphenous vein. Damage to the main part of these nerves occurs in about 1 per cent of operations, but small areas of anaesthesia may occur more frequently (in up to 10 per cent of patients).

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