

PERIPHERAL VASCULAR DISEASE

1 Peripheral Arterial Disorders

1.1 Introduction and Prevalence

These disorders are grouped as follows:^{[1][2][3]}

1. Lower limb ischaemia
2. Extra-cranial arterial disease
3. Aneurysms
4. Upper limb ischaemia
5. Mesenteric arterial occlusion and renal arterial stenosis.

Chronic lower limb ischaemia varies in severity. It is usually due to atherosclerotic occlusion of arteries at various anatomical levels. Functional restrictions mirror the severity of ischaemia and the degree of collateral circulation.

The prevalence of chronic lower limb ischaemia ranges between 0.35%-9% in men and 1.2% -3% in women. The annual incidence of claudication ranges from 0.4%-1.3% in men and 0.2%-0.7% in women.^[4]

Peripheral arterial disease can cause ulcers due to tissue ischaemia. The arterial ulcers often signify severe ischaemia. Arterial ulcers are usually confined to a toe or a limited part of the forefoot.

Upper limb ischaemia results most commonly from thoracic outlet syndrome and atherosclerotic occlusion. The resultant functional restriction is termed upper limb claudication.

Acute, critical limb ischaemia affects the viability of the whole limb and emergency treatment is necessary to save the limb. Such situations are not encountered in the setting of disability analysis and therefore are not considered in detail here.

Aneurysms are generally asymptomatic but can present with life or limb threatening complications depending upon their location. They generally cause no functional impairment. The same is true of mesenteric and renal arterial occlusion. Extra-cranial arterial occlusion usually affects the carotid artery and is associated with transient ischaemic attacks and strokes.

1.2 Symptoms and Signs

The affected lower limb is cold and pale. In chronic disorders, the epidermis may be thin and atrophic (trophic changes).

Chronic arterial insufficiency of the lower limbs presents as muscular pain in the calf brought on and worsened by exercise. The patient limps with the pain, hence the term intermittent claudication. The pain forces the patient to stop walking, whereupon the pain subsides within a minute or two. If the exercise is then

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resumed, the pain recurs after walking the same distance. The pain is almost always in the calf irrespective of the anatomical level of arterial obstruction.

Buttock and thigh pain, along with impotence (Leriche syndrome) indicate aorto-iliac occlusion.

The severity of the ischaemia is measured in terms of the claudication distance. This is the distance walked before onset of intermittent claudication and can vary between 30 metres and several hundred metres. It provides invaluable information to the disability analyst. Pedal pulses may not be palpable or may disappear on exercise.

Buerger's test is positive. This means that there is demonstrable pallor in the foot on elevating the affected limb in the supine position, followed by reactive hyperaemia in that foot if the legs are then hung over the edge of the bed.

The Ankle-Brachial Pressure Index (ABPI) is a very sensitive and objective indicator of lower limb ischaemia.^{[2][3][4]} Refer to **Appendix A** for a description of ABPI. Toe pressure measurements are equally sensitive but not practicable in the routine clinical setting.

With increasing severity of ischaemia, rest pain may occur. Rest pain usually occurs in the skin of the foot, is burning in character and occurs on resting in bed. Hanging the leg over the edge of the bed relieves the rest pain.

Vascular ulcers due to ischaemia may be present at the extreme periphery. Capillary return may be sluggish and a change from pallor to dusky colour in the affected limb signals worsening of ischaemia with pre-gangrene. Patchy and localised necrosis may develop.

Upper limb ischaemia is much rarer due to a rich collateral supply. Diagnostic features of underlying conditions (Raynaud's disease, cervical rib etc.) may be evident. Symptoms may include claudication-like pain on prolonged use of affected upper limbs, especially reaching overhead repeatedly. This is a feature of cervical rib as vessels to the arm become more compressed when reaching overhead.

1.3 Confirming the diagnosis

Clinical diagnosis is confirmed by the following investigations:

1. Colour ultrasound Doppler studies
2. Arteriogram
3. Digital Subtraction Angiography
4. X-rays/MRI for cervical rib.

1.4 Differential Diagnosis

- *Musculo-skeletal/arthritis pain:* Pain is variable. Walking distance is highly

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variable.

- *Neurogenic claudication*: Pain is related to posture rather than exertion, takes longer (> 30 min) to recede and may well be associated with paraesthesia. The neurogenic pain is usually sited anteriorly or laterally in the lower leg, not in the calf.

1.5 Treatment

The treatment of chronic arterial insufficiency of lower limbs is expectant, with managed activity tailored around the symptoms. Walking 80% of the claudication distance, then resting before resuming walking, is to be encouraged. The claudication distance may improve due to development of collateral circulation and due to muscle retraining.

Clinically overt atherosclerotic disease is associated with higher prevalence of coronary artery disease, strokes, abdominal aneurysms and renal arterial stenosis. Long term treatment with daily aspirin reduces mortality due to cardiovascular causes in this group of patients.

The patients should be actively encouraged to stop smoking and other cardiovascular risk factors such as hypertension and hyperlipidaemia need to be treated. Low dose thiazide diuretics and calcium channel blockers are the preferred drugs for treatment of hypertension.

Blood sugar control needs to be optimal in diabetic patients.

Anticoagulant medication is of no benefit and is associated with significant risk of bleeding events. However, oral anticoagulants may be indicated after bypass grafting.

Worsening ischaemia may necessitate angioplasty or vascular bypass operations. Severe critical ischaemia may end in amputation.

Ulcers need regular dressings and expectant treatment and avoidance of infection. Thrombo-endarterectomy is reserved for carotid artery stenosis.

In critically ischaemic lower limbs where surgical reconstruction is difficult, intravenous (IV) guanethidine block, papaverine, prostaglandin analogues and naftidrofuryl oxalate have all demonstrated promising results. IV guanethidine is administered on a day case basis whereas the latter two require IV infusions over several days limiting their usefulness. Papaverine has a very transient effect.

Lumbar sympathectomy (either surgical or by aqueous phenol injections) has limited value. It may help heal ulcers in severe ischaemia by improving blood flow to the skin. Blood flow to muscle is not improved, hence it is of no use in intermittent claudication. Unfortunately only 15% of the treated patients obtain sufficient relief to avoid bypass operation or amputation.

Cervical rib may need excision. Stenosis of the subclavian artery may require bypass grafting or angioplasty.

1.6 Prognosis

In cases with an identified solitary cause of obstruction, treatment directed to the cause yields good results – for example a solitary embolus or a cervical rib.

In chronic lower limb ischaemia due to generalised atherosclerosis, there is some improvement in claudication distance with a supervised exercise regimen. On five-year review of patients with claudication, approximately 75% remain stable or improve symptomatically, 20% develop worsening claudication and 5% develop critical ischaemia with 1% undergoing limb amputation.^[1]

Bypass grafting or angioplasty for worsening, severe ischaemia in the lower limbs both produce good results.^{[1][2][3]}

Patency rates between 68% and 84% are achieved in the short term for upper limb arterial reconstruction.^[5] Long term patency results of angioplasty for the upper limbs are quoted between 75%-99%.^[5]

Patients with carotid artery stenosis have a mortality rate of 5% per annum over 5 years both in the surgically and medically treated groups.

1.7 Main Disabling Effects

In assessing claimants, arterial disorders of the lower limbs are most likely to affect walking and climbing stairs. The range of disability seen varies widely. Claudication may limit walking to distances of between 30 metres to several hundred metres.

Upper limb ischaemia may affect upper limb functions such as lifting and carrying, manual dexterity and reaching. Fatigue and pain of upper limb muscles on activity is reported in upper limb ischaemia. The level of exertion needed to trigger the symptoms is fairly constant in an individual.

The typical day history is helpful in clarifying walking distance. In individual cases, a consistent history should be sought. Despite the variable range of functional impairment between different individuals, marked variability in an individual is unlikely to be reported, i.e. the distance walked before onset of intermittent claudication is constant.

The American Medical Association's *Guides to the Evaluation of Permanent Impairment* are based on symptom history, physical examination findings, surgical history, response to treatment and diagnostic tests. Refer to **Appendix B** and **C** for lower limb and upper limb disability criteria derived from those devised by the American Medical Association (AMA). These criteria are primarily looking at functional impairment.

The US Social Security Administration uses different criteria to diagnose disability due to arterial disorders. Refer to **Appendix D** for details.

2 Venous Disorders

2.1 Introduction and Prevalence

2.1.1 Deep Vein Thrombosis

Acute deep vein thrombosis (DVT) necessitates urgent treatment and is not seen in the disability analysis setting.

Annual incidence is estimated at 1 per 1000 persons per year with a lifetime incidence of 2% - 5%.^[6]

The severity of subsequent limb problems usually reflects the severity of the initial thrombosis. DVT occurs as a complication of major operations, multiple fractures, and other major illnesses requiring prolonged immobilisation.

There has been much recent publicity about so called 'economy class syndrome' - thrombotic episodes occurring during long haul air travel. Use of oral contraceptives, smoking and pregnancy are other recognised risk factors.

The subsequent recanalisation of the veins damages the valves, which become incompetent. Venous hypertension can then lead to incompetence of the superficial venous system causing varicosities, lower limb swelling, dermal changes and venous ulcers.

2.1.2 Varicose Veins

These are dilated, tortuous and prominent superficial veins of the lower limbs. Though they are very common (prevalence of 20% at the age of 20 years and of 80% at the age of 60 years) only about 12% of those affected develop symptoms.^[3] Varicose veins affect 15% of men and 25% of women overall.^[7] The long saphenous system is affected in about 90% of the patients and the short saphenous system in about 25%.^[3]

Abnormal communications between the deep and superficial veins seem to be an important aetiological factor as is incompetence of the valves at the junctions of the deep and superficial veins. Hereditary factors also seem to play a part.

2.1.3 Venous Ulcers

Venous ulcers are usually sited around the medial malleolus. Associated dermal changes include pigmentation, atrophy of cutaneous fat and hardening of tissues by fibrosis. The prevalence of venous ulcers is estimated to be 0.5% - 1.0%.^[8]

2.2 Symptoms and signs

Acute presentation of deep vein thrombosis (DVT) consists of pain and swelling of the calf and ankle along with intense calf tenderness.

The thigh may be swollen if the DVT extends proximally.

The foot is warm and not pale. Pulses may be difficult to feel due to the oedema, but can be detected by ultrasound Doppler. The ABPI and the capillary blood flow are normal.

In the chronic post-thrombotic limb there is brawny oedema, atrophy of cutaneous fat and dermal fibrosis. Narrow ankle due to fat atrophy with proximal oedema results in what is known as champagne bottle leg.

Varicose eczema may be present. Red cell extravasation may lead to unsightly dermal pigmentation due to deposition of haemosiderin. The skin above the medial malleolus is at great risk of ulceration. Pain and swelling are present on prolonged walking and standing.

Simple varicose veins present as tortuous, dilated and prominent superficial veins. Aching pain is present on prolonged walking and standing and it is relieved on elevation of the lower limb. Foot swelling, dermal changes and ulcers similar to those due to DVT may be present. Dilated veins are vulnerable to trauma.

The long saphenous vein is more commonly involved than the short saphenous vein. Some patients complain of unsightly spider veins, which are not true varicose veins. Elevating the limb and applying a tourniquet at different levels along the limb (starting proximally and going distally) and then standing up helps the clinician to find the level of the incompetent perforator vein. This test is important only for the treating clinician to address the offending perforator vein.

2.3 Confirming the diagnosis

Diagnosis of varicose veins is largely clinical though underlying DVT needs to be ruled out by ultrasound Doppler studies. Diagnosis of DVT is confirmed by the following investigations:

1. Ultrasound Doppler studies
2. Venogram (Gold standard).

2.4 Differential Diagnosis

Calf muscle pain due to any reason may mimic DVT – commonest confounding pathologies include compartment syndrome, non-specific muscular pain and a ruptured Baker's cyst at the back of the knee. Varicose veins are clinically obvious and diagnosis is not usually a problem.

2.5 Treatment

Anticoagulation for a period of at least 3 months is recommended. Long term anticoagulation is needed for cases of recurrent DVT.

The post-thrombotic problems needing active treatment are ulcers and associated cellulitis.

Most ulcers can be healed by non-operative treatment. Graded compression stockings may be used with the pressure being greatest at the ankle and progressively less further up the leg. Walking is to be encouraged along with competent bandaging. Removal of necrotic slough, skin grafting and antibiotics are other measures that may need to be administered. Effective elastic support and graded compression all day except when in bed may be needed for life.

The main indication for treatment of varicose veins is usually cosmetic. However aching legs, varicose eczema and ulcers, superficial thrombophlebitis and haemorrhage may necessitate treatment. Injection sclerotherapy on a day case basis may be adequate for small varicosities below the knee but is unsuitable for major varicosities.

Surgical stripping of major varicose veins is a successful procedure. The patient is mobilised immediately and walking at least 2 km outdoors is encouraged from day 2. Most patients can drive the day after and are able to return to work a week after the operation.

2.6 Prognosis

Post-thrombotic problems and venous ulcers respond favourably to bandaging, graded compression and mobilisation.

Up to 90% of venous ulcers heal completely after surgical treatment, with excellent long term results when the venous ulcers are a consequence of superficial and perforator incompetence only.^[8] The presence of deep venous incompetence is associated with poor ulcer healing and higher recurrence rates.^[8]

Varicose veins respond very well to surgical treatment (day case basis).

2.7 Main disabling effects

Post-thrombotic syndrome varies in severity. Extreme cases are characterised by painful intractable ulcers and grossly reduced mobility. Even in less extreme cases the functional impairment may be significant.^[6]

Venous disorders affect prolonged standing and walking long distances. Patients are usually encouraged to walk at least 2 km daily postoperatively, and when healing of ulcers needs to be promoted.

Walking up to 2 km should be achievable and standing is unlikely to be significantly restricted.

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However, venous disorders that are poorly controlled or are associated with non-healing ulcers may cause functional restriction at least until healing has occurred. Recurrent problems may lead to permanent impairment in prolonged walking and standing to varying levels. History, examination and account of typical day will help the disability analyst to evaluate the level of impairment. If there is impairment in walking and standing, then a corresponding degree of impairment may be present in climbing stairs.

Appendix A - The Ankle-Brachial Pressure Index (ABPI)

In the upright position, the blood pressure at the ankle is slightly higher than the brachial blood pressure. The ratio of the ankle blood pressure to the brachial blood pressure is defined as ABPI and is normally >1 , the range of normal being 0.8 – 1.2.

ABPI of <0.8 is the single, strongest clinical indicator of lower limb ischaemia.

Decreasing value of ABPI under 0.8 reflects increasing severity of ischaemia.

Appendix B - Functional impairment criteria in lower limb ischaemia

| Minimal Impairment | Mild Impairment | Moderate Impairment | Moderately Severe Impairment | Severe Impairment |
|--|---|--|---|--|
| No claudication, no rest pain | Intermittent claudication on walking > 100m at average pace | Intermittent claudication on walking >25m and <100m at average pace | Intermittent claudication on walking <25m or intermittent rest pain | Severe & constant rest pain |
| and | or | or | or | or |
| Transient oedema | Persistent moderate oedema incomplete control by elastic supports | Marked oedema partially controlled by elastic supports | Marked oedema not controlled by elastic supports | Amputations at or above the ankles of two extremities, with evidence of persistent vascular disease or of persistent, widespread, or deep ulceration involving two or more extremities |
| and | or | or | or | |
| On physical exam not more than the following findings are present: loss of pulses; minimal loss of subcutaneous tissue; calcification of arteries on X-rays; asymptomatic dilation of arteries or veins, not requiring surgery and not requiring curtailment of activity | Vascular damage evidenced by a sign such as healed, painless stump of an amputated digit showing evidence of persistent vascular disease, or a healed ulcer | Vascular damage evidenced by a sign such as healed amputation of two or more digits of one extremity, with evidence of persisting vascular disease or superficial ulceration | Vascular damage evidenced by signs such as healed amputation at or above an ankle, or amputation of two or more digits of two extremities, with evidence of persistent vascular disease or persistent, widespread, or deep ulceration involving one extremity | |

Appendix C - Functional impairment criteria in upper limb ischaemia

| Minimal Impairment | Mild Impairment | Moderate Impairment | Moderately Severe Impairment | Severe Impairment |
|---|---|---|--|--|
| No claudication, no rest pain | Intermittent claudication on severe usage of the upper limb | Intermittent claudication on mild upper limb usage | Intermittent claudication on mild upper limb usage | Severe & constant rest pain of upper limb use |
| and | or | or | or | or |
| Transient oedema | Persistent moderate oedema incomplete control by elastic supports | Marked oedema partially controlled by elastic supports | Marked oedema not controlled by elastic supports | Amputations at or above the wrists of both limbs, or amputation of all digits of both limbs with evidence of persistent, widespread, or deep ulceration involving both upper limbs |
| and | or | or | or | or |
| On physical exam not more than the following findings: loss of pulses; minimal loss of subcutaneous tissue of fingertips; calcification of arteries on X-rays; asymptomatic dilation of arteries or veins, not requiring surgery or curtailment of activity | Vascular damage evidenced by a sign such as healed, painless stump of an amputated digit showing evidence of persistent vascular disease, or a healed ulcer | Vascular damage evidenced by a sign such as healed amputation of 2 or more digits of 1 limb, with evidence of persisting vascular disease or superficial ulceration | Vascular damage evidenced by signs such as healed amputation at or above a wrist, or amputation of 2 or more digits of both limbs, with evidence of persistent vascular disease or persistent, widespread, or deep ulceration involving 1 limb | |
| and | or | or | or | or |
| Raynaud's at <0°C readily controlled by medication | Raynaud's at <4°C controlled by medication | Raynaud's at <10°C partially controlled by medication | | Raynaud's at 20°C poorly controlled by medication |

Appendix D - The US Social Security Administration Criteria

One of the following 4 criteria is needed to diagnose disability due to arterial disorders:

1. Amputation at or above the tarsal level.
2. Resting ABPI < 0.5.
3. In cases with ABPI > 0.5, a decrease in ankle BP of 50% or more below resting levels on exertion and the BP takes more than 10 minutes to return to pre-exercise levels.
4. Severe claudication with failure to visualise the common or the deep femoral artery on arteriogram.