ABC of arterial and venous disease: Chronic lower limb ischaemia

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Peripheral vascular disease commonly affects the arteries supplying the leg and is mostly caused by atherosclerosis. Restriction of blood flow, due to arterial stenosis or occlusion, often leads patients to complain of muscle pain on walking (intermittent claudication). Any further reduction in blood flow causes ischaemic pain at rest, which affects the foot. Ulceration and gangrene may then supervene and can result in loss of the limb if not treated. The Fontaine score is useful when classifying the severity of ischaemia.

Although many patients with claudication remain stable, about 150-200 per million of the population progress to critical limb ischaemia (Fontaine III or IV) each year. Many patients with critical limb ischaemia can undergo revascularisation, which has a reasonable chance of saving the limb. A recent audit by the Vascular Surgical Society found a success rate of over 70% for these patients. However, many patients still require major amputation. Rehabilitation of elderly patients after amputation can prove difficult, with high community costs. Critical limb ischaemia has been estimated to cost over £200m a year in the United Kingdom.

**Intermittent claudication**

**History and examination**

A history of muscular, cramp-like pain on walking that is rapidly relieved by resting, together with absent pulses, strongly supports the diagnosis of intermittent claudication. Disease of the superficial femoral artery in the thigh results in absent popliteal and foot pulses and often causes calf claudication. Disease of the aorta or iliac artery results in a weak or absent femoral pulse, often associated with a femoral bruit. Disease at this level may cause calf, thigh, or buttock claudication.

The dorsalis pedis artery lies superficially on the dorsum of the foot, although its position varies considerably. The posterior tibial artery lies deeper behind the medial malleolus. Many healthy people have only one foot pulse. The popliteal pulse can be difficult to palpate in muscular patients. A prominent popliteal pulse suggests the possibility of a popliteal aneurysm.
Differential diagnosis
The pain of nerve root compression can be mistaken for vascular claudication. A careful history can usually distinguish nerve root compression, especially sciatica due to compression of the lumbosacral root. However, compression of the cauda equina due to spinal stenosis can be more difficult to diagnose. This condition usually causes pain that radiates down both legs. Although the pain is made worse by walking, it also comes on after prolonged standing and is not rapidly relieved by rest, unlike vascular claudication.

Investigation
There are many causes of leg pain that can occur in the presence of asymptomatic peripheral vascular disease. Therefore, the absence of pulses does not necessarily imply a causal link. Furthermore, the presence of pulses at rest does not exclude symptomatic peripheral vascular disease. A good history together with an ankle brachial systolic pressure index of less than 0.9 confirms the diagnosis.

Exercise testing provides an objective measurement of walking distance, and highlights other exercise limiting conditions such as arthritis and breathlessness. However, exercise testing takes time, and many patients find it difficult or impossible to walk on a treadmill. Only those with a good history of claudication and normal resting ankle brachial systolic pressure indexes require an exercise test.

Duplex ultrasound scanning is useful for delineating the anatomical site of disease in the lower limb. Many hospitals still use arteriography for this purpose or when the results of duplex scanning are equivocal. This invasive and expensive investigation should not be requested unless there is a plan to proceed with revascularisation, if possible.

Principles of treatment
Intermittent claudication seems a relatively benign condition, although severe claudication may preclude patients from manual work. The risk of generalised vascular disease is probably more important. Patients with claudication have a three times higher risk of death compared with age matched controls. Modification of risk factors is therefore vital to reduce death from myocardial infarction and stroke. All patients should be advised to stop smoking and take regular exercise. They should also be screened for hyperlipidaemia and diabetes. Patients with peripheral vascular disease benefit from regular chiropody, and those with diabetes should attend a foot clinic. Obesity reduces exercise capacity, and losing weight will improve the walking distance.

Drug treatment
All patients with peripheral vascular disease benefit from aspirin (75-300 mg/day) because this reduces the risk of cardiovascular events. Patients who are intolerant of aspirin should take dipyridamole (200 mg, twice daily) or clopidogrel (75 mg/day). Naftidrofuryl may improve the walking distance of patients with moderate claudication (less than 500 m), but it is not known if it affects the outcome of the disease. The evidence to support naftidrofuryl is controversial, and patients prescribed it should be reassessed after three to six months.

Exercise programmes
A recent meta-analysis of 21 supervised exercise programmes showed that training for at least six months, by walking to near maximum pain tolerance, significantly improved pain free and maximum walking distances. The only controlled trial comparing an exercise programme with percutaneous transluminal angioplasty found that exercise was better. Exercise programmes are cheaper than percutaneous
transluminal angioplasty or surgery, although long term compliance seems poor.

Endovascular techniques
The number of percutaneous transluminal angioplasties performed for claudication has risen steeply in recent years. In some situations endovascular techniques have virtually replaced conventional surgery. Percutaneous transluminal angioplasty seems best suited for stenoses or short occlusions of the iliac and superficial femoral vessels, with one year patency rates of 90% and 80% respectively. Angioplasty carries a small but definite risk of losing the limb because of thrombosis or embolisation, and patients should be informed of this risk.

Metallic stents push back the atheroma and improve on the initial lumen gain after angioplasty alone. The indications for iliac stents include a residual stenosis or dissection after angioplasty and long occlusions, but there seems little evidence to justify their routine use. Deployment of stents more distally has produced disappointing results due to high restenosis rates.

Surgery
The role of bypass for longer arterial occlusions remains poorly defined because of a lack of proper trials comparing it with percutaneous transluminal angioplasty and conservative treatment. Polyester (Dacron) aortobifemoral bypass grafts have five year patency rates of over 90% but are associated with a mortality of up to 5%. Complications include graft infection and postoperative impotence. Femoropopliteal bypass grafting, using autologous long saphenous vein, polyester, or polytetrafluoroethylene (Goretex) yields patency rates of less than 70% at five years. The early patency of prosthetic grafts seems similar to that of vein grafts, although the long term results seem less good. Femoropopliteal bypass grafts should rarely be used for patients with claudication.

Critical limb ischaemia
History and examination
Patients with critical limb ischaemia often describe a history of deteriorating claudication, progressing to nocturnal rest pain. Ulceration or gangrene commonly results from minor trauma. Nocturnal rest pain often occurs just after the patient has fallen asleep when the systemic blood pressure falls, further reducing perfusion to the foot. Hanging the foot out of bed increases perfusion and produces the typical dusky red hue due to loss of capillary tone. Elevation causes pallor and venous guttering. Inspect the foot carefully for ulceration under the heel and between the toes. Swelling suggests deep infection. If you can palpate foot pulses consider an alternative cause of pain, such as gout. Patients with critical limb ischaemia require urgent referral to a vascular surgeon.

Investigation
The ankle brachial systolic pressure index is usually less than 0.5. Arterial calcification may result in falsely increased pressures, and caution is needed when relying on Doppler pressures alone, especially in diabetic patients. All patients with critical limb ischaemia should ideally have arteriography with a view to endovascular treatment, if feasible. Duplex scanning may be used instead of angiography and for mapping of the long saphenous vein before distal bypass surgery. Dependent Doppler or pulse generated run-off can help to determine the most suitable artery to receive a distal bypass graft if these cannot be identified by angiography.
Principles of treatment
The same principles and techniques used to treat claudication also apply to critical limb ischaemia. However, critical limb ischaemia is usually caused by multilevel disease, which means that success rates are lower. Treatment focuses on saving the limb, although modification of risk factors remains important.

Endovascular treatment
Percutaneous transluminal angioplasty or stenting of proximal disease may relieve ischaemic rest pain, but healing of ulceration or gangrene usually requires restoration of foot pulses. This may necessitate extensive angioplasty of the superficial femoral, popliteal, and tibial arteries. Good results have been reported with subintimal angioplasty. Endovascular treatment can also reduce the magnitude of subsequent surgery.

Surgery
Patients with a pattern of arterial disease considered unsuitable for endovascular treatment will usually require surgery. Fit patients with proximal disease benefit greatly from aortobifemoral bypass grafting. In unfit patients the options include crossfemoral bypass for unilateral disease or axillobifemoral bypass for bilateral disease. These extra-anatomic procedures have lower patency rates. Many patients with distal disease will require bypass grafting to the popliteal or crural arteries below the knee. Autologous vein grafts give the best patency rates (70% at one year). Postoperative duplex surveillance may improve patency by permitting the detection and treatment of vein graft stenoses before occlusion occurs.

Amputation
Patients with unreconstructable peripheral vascular disease, fixed flexion deformities, or extensive tissue loss usually require a major amputation. Preservation of the knee joint has enormous advantages for wearing artificial limbs and subsequent mobility. However, there is little point in risking a non-healing, below knee amputation if the patient seems unlikely to walk again. Similarly, a patient with good prospects of wearing an artificial limb will fare better with an above knee amputation, if below knee amputation seems unachievable. Local amputation of ulcerated or gangrenous toes will not heal without revascularisation.

Pain relief
Critical limb ischaemia causes severe pain that requires narcotic analgesia to provide relief. A slow release opiate such as morphine seems a good option. Opiates can be supplemented by non-steroidal anti-inflammatory drugs if these are not contraindicated. Apart from rehydration, adequate analgesia alone may be the best treatment for patients with dementia or other severe comorbidity. If opiate analgesia remains inadequate, then lumbar sympathectomy (surgical or chemical) or spinal cord stimulation may help.

About 20-30% of patients with critical limb ischaemia have unreconstructable disease. A meta-analysis of six randomised trials of Boprost, a stable prostacyclin analogue, found that infusion of this drug reduced the death and amputation rate. Phantom limb pain may complicate major amputation. Amitriptyline, carbamazepine, transcutaneous nerve stimulation, and acupuncture can help in this situation.

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Methods of pain relief for critical limb ischaemia
- Slow release opiate analgesia—for example, morphine sulphate
- Prostacyclin analogues*—for example, Iloprost or prostaglandin E1 (alprostadil)
- Chemical or surgical lumbar sympathectomy
- Dorsal column spinal stimulation

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Further reading

The ABC of arterial and venous disease is edited by Richard Donnelly, professor of vascular medicine, University of Nottingham and Southern Derbyshire Acute Hospitals NHS Trust (richard.donnelly@nottingham.ac.uk) and Nick J M London, professor of surgery, University of Leicester, Leicester (nms16@leicester.ac.uk). It will be published as a book later this year.