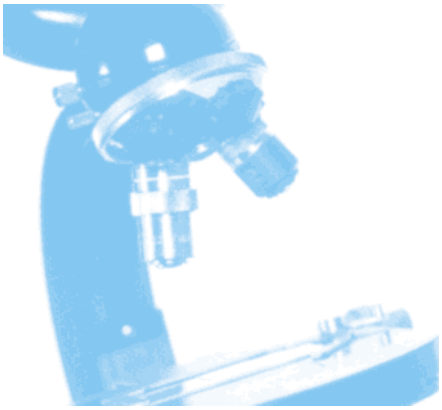

Toolbox

Chronic lower limb ischemia

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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 ischemic 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 ischemia (see box).

Although many patients with claudication remain stable, about 150 to 200 per million of the population progress to critical limb ischemia (Fontaine III or IV) each year. Many patients with critical limb ischemia can undergo revascularization, 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. Many patients, however, still require major amputation. Rehabilitation of elderly patients after amputation can prove difficult and costly.

INTERMITTENT CLAUDICATION

History and examination

A history of muscular, cramplike 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 (figure 1) results in absent popliteal and foot pulses and often causes calf claudication.

Fontaine classification of chronic leg ischemia

Stage I	Asymptomatic
Stage II	Intermittent claudication
Stage III	Ischemic rest pain
Stage IV	Ulceration or gangrene, or both

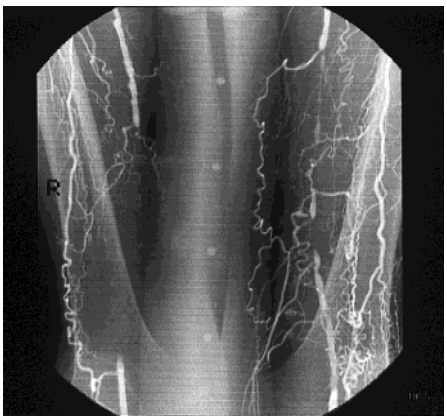

Figure 1 Angiogram showing bilateral occlusions of superficial femoral arteries in thighs. Collaterals arising from the profunda femoris artery can functionally bypass this occlusion.

Disease of the aorta or iliac artery results in a weak or absent femoral pulse, often associated with a femoral bruit (figure 2). 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 (figure 3). 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 (figure 4). A prominent popliteal pulse suggests the possibility of a popliteal aneurysm.

Figure 2 Method of palpating the femoral pulse in the skin crease of groin. Counterpressure on the lower abdomen pushes the skin crease toward the inguinal ligament and reduces the risk of missing the pulse.

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. Compression of the cauda equina due to spinal stenosis, however, 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

Many causes of leg pain 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 dis-

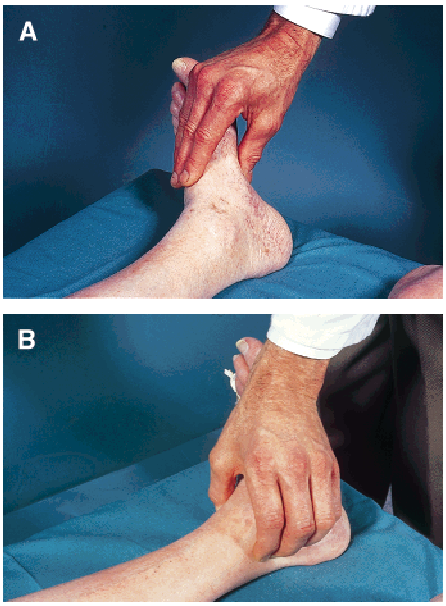

Figure 3 Method of palpating doralis pedis (A) and posterior tibial (B) pulses. Examine pulses from the foot of the bed, keeping the fingers flat for the dorsalis pedis and using the fingertips for the posterior tibial while applying counterpressure with the thumb.

Figure 4 Method of palpating popliteal artery with patient's knee slightly flexed. Use thumbs to apply counterpressure while palpating the artery, which lies deep in the popliteal fossa, with fingers.

ease. A good history together with an ankle brachial systolic pressure index of less than 0.9 confirms the diagnosis (figure 5).

Exercise testing provides an objective measurement of walking distance and highlights other exercise limiting conditions, such as arthritis and breathlessness. Exercise testing takes time, however, 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 indices require an exercise test.

Duplex ultrasound scanning is useful for delineating the anatomic site of disease in the lower limb (figure 6). 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 revascularization, if possible.

Principles of treatment

Intermittent claudication seems a relatively benign condition, although severe claudication may preclude patients from manual work (see box). The risk of generalized vascular disease is probably more important. Patients with claudication have 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 participate in regular exercise. They should also be screened for hyperlipidemia and diabetes. Patients with peripheral vascular disease benefit from regular podiatric care, and those with diabetes should be seen in a foot clinic. Obesity reduces exercise capacity, and losing weight will improve the walking distance.

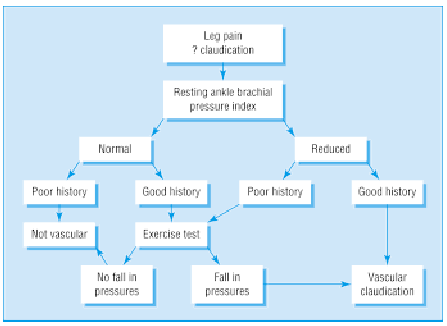

Figure 5 Algorithm for investigation of suspected intermittent claudication

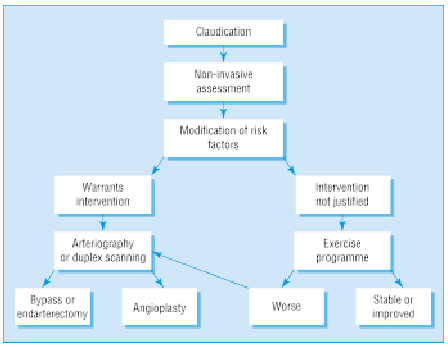

Figure 6 Algorithm for treatment of intermittent claudication

Drug treatment

All patients with peripheral vascular disease benefit from taking aspirin (75 to 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 clopidrogrel bisulfate (75 mg/day). Naftidrofuryl, currently available in the United Kingdom, may improve the walking distance of patients with moderate claudication (<500 m [<550 yd]), but evidence to support its use is controversial, and its effect on the outcome of the disease is not known.

Exercise programs

A recent meta-analysis of 21 supervised exercise programs showed that training for at least 6 months, by walking to near-maximum pain tolerance, significantly improved painfree and maximum walking distances (figure 7). The only controlled trial comparing an exercise program with percutaneous transluminal angioplasty found that exercise was better. Exercise programs are cheaper than percutaneous transluminal angioplasty or surgery, although long-term compliance seems poor.

Factors that may influence the decision to treat claudication

For	Against
Severe symptoms	Short history
Job affected	Continued smoking
No better after exercise training	Severe angina or chronic obstructive airway disease
Stenosis or short occlusion	Long occlusion
Proximal disease	Distal disease
Unilateral disease	Multilevel disease

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 1-year patency rates of 90% and 80%, respectively

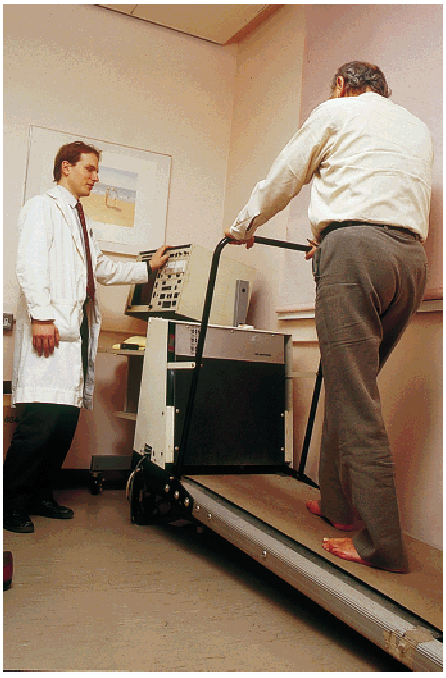

Figure 7 Treadmills can be used for objective measurement of walking distance and for exercise training

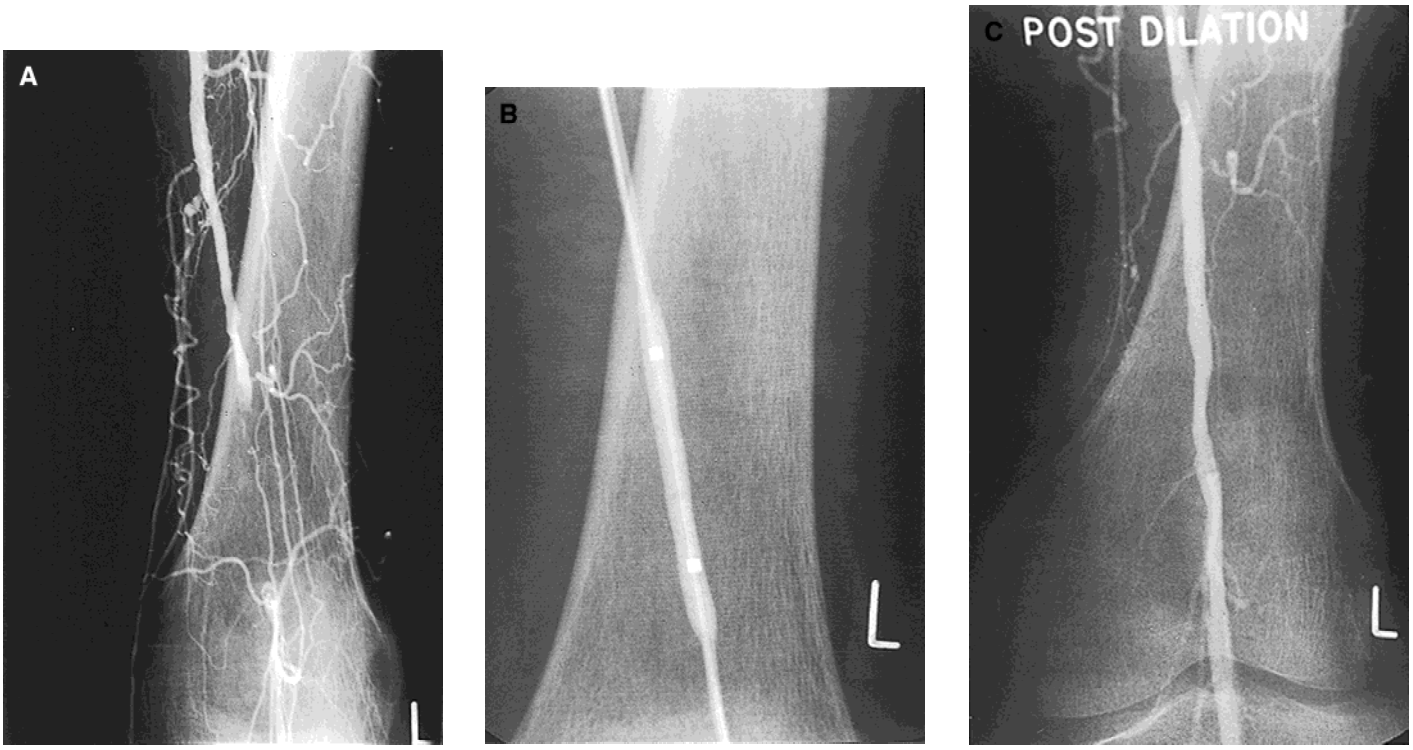

Figure 8 Short occlusion of left popliteal artery (A), treated by percutaneous transluminal angioplasty. The balloon catheter is passed through the occlusion over a guidewire and inflated (B). Appearance after angioplasty is shown in C.

(figure 8). Angioplasty carries a small but definite risk of losing the limb because of thrombosis or embolization, and patients should be informed of this risk.

Metallic stents push back the atheroma and improve on the initial lumen gain after angioplasty alone (figure 9). 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 surgical bypass grafting 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 5-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 (Gore-Tex) yields patency rates of less than 70% at 5 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 ISCHEMIA

History and examination

Patients with critical limb ischemia 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 (figure 10). 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 ischemia 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 patients with diabetes. All patients with critical limb ischemia 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.

Figure 9 Occlusion of the right common iliac artery before (left) and after (right) insertion of stent

Figure 10 Critically ischemic foot displaying typical dusky red hue on dependency (ischemic rubor)

Dependent Doppler or pulse-generated runoff 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 ischemia. Critical limb ischemia, however, is usually caused by multilevel disease involvement, which means that success rates are lower. Treatment focuses on saving the limb (figure 11), although modification of risk factors remains important.

Endovascular treatment

Percutaneous transluminal angioplasty or stenting of proximal disease involvement may relieve ischemic 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 using subintimal angioplasty. Endovascular treatment can also reduce the magnitude of subsequent surgery.

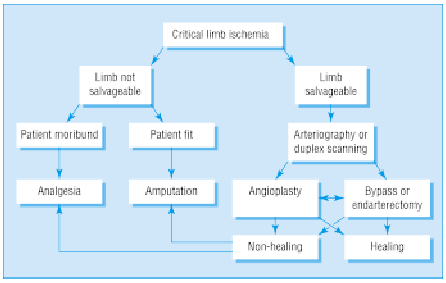

Figure 11 Algorithm for treatment of critical limb ischemia

Surgery

Patients with a pattern of arterial disease considered unsuitable for endovascular treatment will usually require surgery (figure 12). Fit patients with proximal disease involvement benefit greatly from aortobifemoral bypass grafting. In unfit patients, the options include cross-femoral 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 1 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. There is little point in risking a nonhealing, below-the-knee amputation, however, 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-the-knee amputation, if below-the-knee amputation seems unachievable. Local amputation of ulcerated or gangrenous toes will not heal without revascularization.

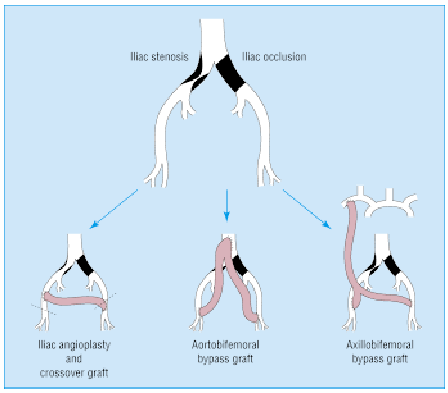

Figure 12 Surgical treatment options for aortoiliac disease

Methods of pain relief for critical limb ischemia

- Slow-release opiate analgesia—for example, morphine sulfate
- Prostacyclin analogues—for example, iloprost or prostaglandin E_1 (alprostadil)
- Chemical or surgical lumbar sympathectomy
- Dorsal column spinal stimulation

Pain relief

Critical limb ischemia causes severe pain that requires narcotic analgesia to provide relief (see box). A slow-release opiate such as morphine seems a good option. Opiates can be supplemented by nonsteroidal 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% to 30% of patients with critical limb ischemia have unreconstructable disease. A meta-analysis of 6 randomized trials of a stable prostacyclin analogue found that infusion of this drug reduced the death and amputation rate. Phantom limb pain may complicate major amputation. Amitriptyline hydrochloride, carbamazepine, transcutaneous nerve stimulation, and acupuncture can help in this situation.

This article comes from *ABC of Arterial and Venous Disease,* which is edited by Richard Donnelly and Nick J M London, and will be published this year by the BMJ Publishing Group.

Further Reading

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