

# The management of intermittent claudication

L Chiu, AK Ahchong, AWC Yip

**Intermittent claudication is a common symptom. It is a marker of generalised atherosclerotic disease and may herald other cardiovascular catastrophes. The aim of management is to reduce the total cardiovascular morbidity and mortality. The functional status and quality of life of severely affected patients can be improved by endovascular and surgical interventions.**

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## Introduction

Claudication is defined as reproducible exercise-induced muscle pain that is relieved by a brief period of rest. There should be little day-to-day variability in the severity and walking distance that precipitates the pain. Intermittent claudication affects at least 10% of the population aged over 70 years in western countries. There have been no local studies of the incidence and prevalence of claudication in Chinese. In our experience, many of those with claudication attribute the exercise-induced pain to arthritis or tolerate the symptom as part of the ageing process. Claudication is a Latin verb that means "to limp." It is a symptom of arterial occlusive disease. The exercise increases the demand for muscle blood flow but it cannot increase to a degree sufficient to meet the demands of the exercising muscle. The patient must have significant arterial stenosis and exercise sufficiently to induce the symptom of relative muscle ischaemia.

An important consideration is that claudication is frequently a marker of generalised atherosclerotic vascular disease. Claudication is associated with possible myocardial infarction, stroke, or amputation. It has been reported that approximately 50% of post-operative deaths in patients with lower extremity

occlusive vascular disease are related to cardiac causes.<sup>1,2</sup> Management of patients with claudication should aim to reduce the total mortality and morbidity from cardiovascular disease by instituting appropriate preventive measures. In patients with severe claudication, physical function and quality of life can be improved by invasive procedures such as percutaneous angioplasty or vascular reconstruction.

## Aetiology and predisposing factors

Most chronic arterial occlusive disease is the result of atherosclerosis. Less common causes include fibromuscular dysplasia, thromboangitis obliterans, muscular entrapment, and subadventitial cystic degeneration.

Apart from advanced age, cigarette smoking is the factor most strongly associated with the development of intermittent claudication. The prevalence of cigarette smoking in different patient series ranges from 75% to 95%.<sup>3,4</sup> Diabetes mellitus, hypertension, hyperlipidaemia, polycythemia, and coagulation abnormality are all significant factors related to the development of peripheral vascular disease.<sup>3,5,6</sup>

## Symptoms

Apart from symptoms of peripheral arterial disease, symptoms of angina pectoris, history of myocardial infarction, transient ischaemic attack, or previous stroke that indicate disease in different vascular beds may be elicited.<sup>6-8</sup>

Department of Surgery, Kwong Wah Hospital, 25 Waterloo Road, Kowloon, Hong Kong

L Chiu, FRCS, FHKAM (Surgery)  
AK Ahchong, FRCS, FHKAM (Surgery)  
AWC Yip, FRCS, FHKAM (Surgery).

Correspondence to: Dr L Chiu

Patients with aortoiliac disease typically complain of exercise-induced grabbing pain in the buttock or thigh. The calves may be involved if femoral-popliteal disease is also present. The extremity pain is consistently produced by the same amount of muscular activity in a given patient and is promptly relieved by cessation of the activity. Unlike other types of exercise-induced pain, the pain of vascular claudication is unrelated to posture. Furthermore, worsening of claudication is not relentless. The intervening improvement is due to the development of collaterals, which may be followed by further segmental stenoses in the arterial tree. Thus, it is common that a sudden deterioration in walking distance is followed by a slow improvement over several months and then followed by a second deterioration.

It is most important to be able to distinguish patients with critical lower limb ischaemia from those with claudication. Critical lower limb ischaemia is manifested by rest pain, with or without non-healing ulcer and gangrene. Ischaemic rest pain is a severe pain not readily controlled by analgesics and is located in the distal part of a chronically ischaemic limb. Pain is usually worse in the forefoot and toes and it is aggravated by elevation and relieved by dependency. Rest pain is often worse at night or when reclining. Once it has been established that the symptom is indeed claudication, the severity is assessed; this is related to the time or distance walked at a constant speed and inclination before the onset of pain.

### Physical examination

Before assessing the lower limbs, signs of other vascular diseases must be carefully sought as they are frequently more important than the claudication. Hypertension is common in those with claudication. Cardiac arrhythmia secondary to previous myocardial infarction may be present. Carotid bruit suggestive of carotid stenosis may be audible.<sup>7</sup> Abdominal examination may reveal an abdominal aortic aneurysm.

A patient who has rest pain has critical ischaemia of the lower extremity and must be treated urgently to avoid a major amputation. Rest pain should never be misdiagnosed as claudication. In both situations, the limb may look relatively normal when horizontal and the peripheral pulses may not be palpable. However, blanch on elevation and rubor on dependency are vital signs of critical ischaemia that are not found in claudication.

### Investigations

The clinical history and physical examination are of fundamental importance. Sometimes it is difficult to differentiate ischaemic pain from other exercise-induced pain such as sciatica, spinal stenosis, venous insufficiency, arthritis, or chronic compartment syndrome. Non-invasive vascular physiology tests including segmental limb pressures are useful diagnostic tools for peripheral vascular disease. A resting ankle-brachial index of 0.5 to 0.8 suggests significant arterial obstruction with intermittent claudication. A blood pressure drop of more than 20 mmHg between two successive segments in the lower limb signifies a haemodynamically significant stenosis.<sup>9</sup> Although claudicants may have normal segmental pressures at rest, exercise may unmask the arterial obstruction and results in post-exercise dropping of ankle pressure by an amount and duration that is proportional to the severity of the arterial occlusive disease.<sup>9</sup> Patients with suspected neurospinal or musculoskeletal disease are best evaluated with a treadmill exercise test. Arterial occlusive disease shows up as an exercise-induced fall in segmental pressure.

Blood tests are performed to screen for risk factors associated with peripheral arterial disease—diabetes mellitus, hyperlipidaemia, and polycythemia. Cardiac testing is important in selecting patients for revascularisation and detecting those patients whose coronary artery disease requires intervention.<sup>2</sup> According to two large prospective studies, the prevalence of asymptomatic carotid stenosis in patients with lower limb ischaemia ranges from 15% to 28.4%.<sup>7,8</sup> A screening carotid duplex scan is therefore indicated in patients who require lower extremity revascularisation, with the exception of patients for whom prophylactic carotid endarterectomy would not be recommended because of comorbid conditions.

Arteriography is not without risk and is reserved for those in whom intervention is contemplated. Arteriographs delineate the arterial obstruction and provide a road map for planning the vascular bypass. Endovascular procedures such as balloon dilatation can also be performed at the same time.

### Treatment

The choice of treatment for intermittent claudication is based on the presence of concurrent illnesses, functional demands, and patient life expectancy. Arguments for the conservative treatment of intermittent claudication include the relatively benign natural course of

the disease,<sup>10-12</sup> the general and local risks associated with invasive procedures, and the limited life expectancy imposed by concurrent diseases. In considering the different interventions, the vascular anatomy will influence the safety, efficacy, and durability of the different procedures.

### ***Risk factor modification***

Risk factor modification through patient education is an important part of the treatment programme for patients with claudication. Conservative management starts with stopping smoking, as smoking is significantly correlated with an increased risk of developing rest pain.<sup>4</sup> An effective means of slowing the progression of arterial disease is to quit smoking. The consumption of foods rich in cholesterol and saturated fat should be reduced. Aggressive treatment of hypercholesterolaemia may be effective in reversing atherosclerotic lesions. The cholesterol-lowering agent, simvastatin, produces significant reductions in the risk of death and morbidity in patients with coronary heart disease.<sup>13</sup> Active treatment of hypercholesterolaemia may also retard the progression of peripheral vascular disease. Although there has not been a controlled trial to document the efficacy of control of diabetes and the treatment of hypertension in improving claudication, the benefits of this strategy in reducing the risk of future cardiovascular events should be recognised.

### ***Exercise conditioning***

Anxiety may be alleviated and quality of life improved if patients understand that the exercise-induced pain is not damaging and that collateral vasculature can be stimulated to open up. The fact that a patient is helping their circulation by walking into the pain is very reassuring and often relieves unnecessary self-imposed limitations. Patients are instructed to walk until claudication occurs, then to rest until the pain subsides. The cycle should be repeated for at least one hour each day. Trials have shown that pain-free walking time increased by an average of 134% after exercise conditioning.<sup>14</sup> Regularity is the hallmark of all successful exercise programmes. The intensity should be as high as can be tolerated, but obviously the contraindications of strenuous exercise have to be observed. Regularity rather than intensity should be stressed by the counselling physician. To improve compliance, the rationale of the exercise programme should also be explained.

### ***Foot care***

Foot care is another important aspect of the management programme. In patients with chronic lower

extremity ischaemia, minor injuries to the feet may set the stage for chronic wound infection, gangrene, and eventual limb loss. Patients are instructed by health care providers against careless nail or callous trimming. The wearing of ill-fitting shoes should be discouraged. They should avoid exposing their feet to strong chemicals, disinfectants, and extreme temperatures. Patients with chronic lower limb ischaemia should keep their feet clean and dry and their feet should be inspected daily for abrasions, ulcerations, or infection. Any foot lesion should be reported to their physician immediately.

### ***Medication***

Medication offers little compared with the benefits of regular exercise and the cessation of smoking. Vasodilating agents are of no proven benefit in patients with claudication. Aspirin seems to have a role in the management of claudication. The high incidence of cardiovascular comorbidities in those with claudication<sup>5,6</sup> justifies the regular use of aspirin. Medication that decreases blood viscosity may improve blood flow in patients with claudication. Although the efficacy of pentoxifylline for claudication is not proven, it is frequently used with a reported symptomatic improvement in 10% to 20% of patients. Chelation therapy is expensive and there is no evidence to support its benefit in occlusive disease of the lower limbs.<sup>15,16</sup>

### ***Invasive procedures***

Patients with mild symptoms need only conservative treatment as described above. The decision to give further or more invasive treatment must be made with consideration of the patient's severity of symptoms, age, and general health. Invasive revascularisation procedures are considered if claudication prevents gainful employment or imposes unacceptable restrictions on daily activities. The choice between traditional vascular reconstruction and percutaneous transluminal procedures depends on the site and morphology of the lesions.

In percutaneous angioplasty, a balloon catheter is introduced into a stenosed segment of artery by Seldinger's technique and the balloon is then inflated to cause partial disruption and dilatation of the stricture. The patients are given daily aspirin after the procedure. Angioplasty carries a definite although small risk. In a series of 667 iliac percutaneous angioplasties, the mortality rate was 0.3% with one death following myocardial infarction and another secondary to bleeding from a ruptured artery. Complications occurred in 7.9% of patients and emergency surgical intervention was required in 1% of patients in the series.<sup>17</sup>

Common complications of angioplasty are haematoma, limb ischaemia, thrombosis, distal embolization of dislodged atheromatous material, dissection of the arterial wall, and false aneurysm. Balloon angioplasty is particularly suitable for large vessel diseases such as iliac artery disease or a short segment of superficial femoral artery stenosis. Angioplasty can also be performed in combination with surgical revascularisation to improve inflow from a diseased iliac vessel before distal reconstruction. In the series of 667 iliac percutaneous angioplasties, an overall 5-year cumulative patency rate of 53.4% ( $\pm$  SD 2.7) was reported.<sup>17</sup>

Angioplasty has opened up a therapeutic dimension for numerous high risk patients with disabling iliac vessel disease from whom surgical treatment has been withheld in the past. Percutaneous transluminal angioplasty of the superficial femoral artery and popliteal artery are associated with a higher initial failure and poor patency rates of 69% and 46% at one and 24 months, respectively.<sup>18</sup> It is therefore controversial to recommend angioplasty to treat claudication secondary to infrainguinal disease, particularly when patients who do well are those with either short segment occlusions or good outflow, who would usually do well with conservative management.

Endovascular stenting is an acceptable treatment for iliac disease. Recent series report satisfactory long term patency rates of 80% to 90%.<sup>19-21</sup> Aorto-bifemoral bypass is the mainstay of treatment for patients with severe claudication secondary to diffuse aortoiliac occlusive disease. Large series have confirmed a mortality rate of 2.5% and a five-year patency rate of more than 90%.<sup>22,23</sup> Aorto-bifemoral bypass is a major surgical procedure, however, with a much greater risk than that associated with axilo-bifemoral bypass. Femoro-femoral crossover grafting is a useful alternative for patients with a relatively normal contralateral common femoral artery. Femoro-popliteal bypass is a safe and durable operation for infrainguinal lesions. The saphenous vein remains the most durable conduit for the arterial bypasses. The cumulative patency rate at five years after femoro-popliteal autogenous vein grafting for claudication ranges from 75% to 86%.<sup>22-24</sup>

Polytetrafluoroethylene (PTFE) graft provides acceptable patency and is an alternative prosthetic material for infrainguinal bypass when a vein is unavailable. The three-year graft patency rate of PTFE graft for above-knee femoro-popliteal bypass is close to that of autologous vein graft.<sup>24-28</sup> For bypasses

to below the knee, the best result is obtained with the in situ saphenous vein technique. In general, a prosthetic graft is not used below the knee except for limb salvage.

### **Post-intervention treatment**

The long term success of endovascular procedures and bypass surgery depends on many factors. The importance of stopping smoking is repeatedly emphasised to the patient. Revascularisation procedures produce more lasting benefit for patients who stop smoking.<sup>29</sup> There is no consensus regarding the administration of antiplatelet agents but giving a daily dose of aspirin, 81 to 325 mg, is common practice among many physicians. Apart from these treatments, patients are encouraged to engage in regular exercise.

### **Conclusion**

Several retrospective studies have estimated that the risk of limb loss in patients treated conservatively for intermittent claudication is about 2% to 8% during a follow up period of two to eight years.<sup>20-22</sup> The relatively benign natural course of intermittent claudication and the limitation on life expectancy imposed by concurrent cardiovascular disease should both be considered before embarking on invasive treatment. Risk factor modification is a prerequisite for the management of intermittent claudication. Unfortunately, less than a quarter of patients give up smoking completely in spite of advice, encouragement, and even threats.<sup>30</sup> Endovascular procedures are suitable for large vessel diseases. Patients with mild to moderate symptoms, however, have little to gain when the endoluminal procedures are successful. Complication of the procedures may call for extensive surgery. Compared with physical training, arterial reconstruction alone, or in combination with subsequent training produces superior results as judged by symptom-free walking distance and mean walking distance.<sup>31</sup> Patient selection is important. There are surgically treated patients who are limited after arterial reconstruction by cardiopulmonary symptoms and cannot fully benefit from the improved blood flow.

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