

# Leg arteries and limb ischaemia

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THE NATIONAL HEALTH SERVICE treats about 12,000 patients per year with lower limb ischaemia (insufficient blood supply) due to blocked leg arteries threatening the legs. Severe damage to the limb will arise leading to amputation if the correct treatment is not provided promptly and the time available for action to be taken varies according to the circumstances of the individual case.

Where the blood flow to all of the leg stops completely there is a window of opportunity of only a few hours before irretrievable damage is done to nerves and muscles. However, where the arterial system is blocked by slowly advancing atheroma (hardening of the arteries) there is an opportunity for alternative routes of arterial supply to open up. Even when a main artery becomes completely blocked, enough blood flow is still present to keep the leg alive – just! Action must be taken within days if the limb is to be restored to health.

## Causes of lower limb arterial disease

The most common association with atheroma of leg arteries is smoking. This is probably a causative factor in about 90% of patients with lower limb arterial disease. Diabetes is also a factor in about 10% of patients. Other conditions, including high blood pressure and high blood cholesterol, may also be part of the problem. It is likely that inherited factors also play a role.

## Symptoms of leg artery disease

In slowly progressive atheroma of the lower limb arteries (the most common site for peripheral arterial disease) gradual narrowing of vessels limits the capacity for blood flow to the leg. At rest, sufficient blood flow is present for the limb to remain in good condition. On exercise, where more blood flow is required for walking or running, the narrowed vessel can no longer provide the leg with enough blood flow to power the muscles. After walking a distance of tens or hundreds of yards, depending on the severity of the arterial disease, pain arises in the calf muscles bringing the patient to a halt. The pain goes after a few minutes and walking can continue.

This condition is referred to as 'intermittent claudication' and is a form of chronic (long standing) lower limb ischaemia. Few patients with this condition suffer severe consequences such as limb amputation. Standard treatment includes smoking cessation, management of high blood pressure and high cholesterol levels and an exercise regime which will lead to an increased walking distance. Surgical intervention to improve the blood supply to the leg can also be considered.

Progression of the narrowing can lead to blocked major arteries with deteriorating blood flow to the lower limb. In patients with slowly advancing atheroma of leg arteries, small arteries gradually enlarge providing an alternative (collateral) route of blood supply to the leg. Even when major arteries are blocked, few symptoms may result although the intermittent claudication will worsen. In some patients the limb ischaemia is so severe that pain in the leg is present at rest. This usually affects the foot at first and occurs at night when the patient is in bed. Diurnal variations lead to a reduced blood pressure during the night reducing the pressure available to push blood through the leg. The pressure in the arteries is increased on sitting or standing and patients with 'rest pain' find that hanging the leg out of bed or sleeping in a chair are helpful.

The ischaemia may be so severe that the skin is damaged and destroyed leading to a chronic non-healing wound of the foot or leg. This situation is referred to as 'critical ischaemia' and requires expeditious intervention by a vascular surgeon to restore flow to the limb in order to avoid amputation. Delay in diagnosis of a few days is acceptable. However, if critical ischaemia persists for several weeks or months, irretrievable damage to the skin, muscles and nerves of the leg will lead to the need for amputation.

Acute limb ischaemia arises when a catastrophe leads to occlusion of a major artery in the leg. This may arise in an artery affected by atheroma when sudden thrombosis of the vessel occurs. Alternatively, a clot may form in another part of the arterial system, most commonly in the heart. This detaches and travels to the leg via the major arteries. The travelling clot is known as an embolism. The embolism is trapped in the leg

arteries, which are narrower than the vessels that leave the heart, and blood flow to the leg ceases immediately. The symptoms of this include: severe pain in the leg, coldness and paleness of the limb, reduced sensation or numbness of the leg, paralysis and loss of the peripheral pulses.

This is a surgical emergency requiring immediate intervention if the limb is to be saved from amputation. The embolism can be removed by an operation or a blocked vessel re-opened or bypassed to restore blood flow to the leg. The muscle and nerves of the limbs are very susceptible to severe ischaemia and begin to die within 6-8 hours of the onset of symptoms. After 24 hours of total ischaemia, amputation is usually the only possible treatment.

## Problems arising from limb ischaemia

Intermittent claudication due to chronic limb ischaemia is relatively common in elderly patients. This group may not even notice any symptoms unless they undertake a brisk walk. The

fig. 1 - Ischaemia of the second toe leading to gangrene



condition is relatively stable and it is uncommon for a serious threat to the lower limb to develop.

Symptoms are dramatic and severe in patients who experience acute limb ischaemia. These patients usually present to the Accident and Emergency department of a hospital where the diagnosis is rapidly recognised and the correct treatment provided. Expedient treatment is required since the window of opportunity is only a few hours. Any unnecessary delay in management may lead to irreversible damage to the limb and could be considered to be substandard treatment.

Adverse outcomes, such as limb amputation due to delay in diagnosis and treatment, is most likely in the those patients with critical limb ischaemia. Some patients report the symptoms of pain in the leg at night, relieved by hanging the leg out of bed, to their general practitioner. This classical history of critical limb ischaemia should lead to clinical examination of the lower limbs with careful attention to the peripheral pulses. The leg may look entirely normal but clinical examination may fail to detect a palpable pulse. This may simply be because ankle pulses can be difficult to feel in some patients. Alternatively the pulse may be absent.

Pulses can be detected reliably using a Doppler ultrasound probe, available to doctors and nurses in general and hospital practice. This device has a small transducer which is placed on the leg and translates the blood flow into an audible pulse. An absent pulse on Doppler ultrasound examination confirms that the blood flow is absent in that vessel. If the pulse is present it is conventional to assess the blood pressure at the ankle by inflating a blood pressure cuff around the limb until the pulse disappears. This indicates the Doppler systolic pressure. This can be compared to the arm blood pressure and a ratio calculated (the ankle:brachial systolic index). Normally the blood pressure at the ankle is the same as that in the arm or slightly higher. Where arteries are blocked in the lower limb, the pressure is lower than the arm. In critical limb ischaemia the ankle pressure is usually less than half that in the arm. This simple test is therefore very useful in assessing the quality of the blood flow to the lower limb.

Some patients present to their GP with one or more black or dark mauve toes (fig. 1). The toes are the most distant part of the limb and critical ischaemia may present with gangrene (black toes) or irretrievably damaged toes requiring amputation. These patients are usually recognised as having a vascular problem and are referred for urgent vascular surgical advice within a few days of presentation.

### Delayed in treatment due to failure to recognise the diagnosis

A group of patients in whom diagnostic confusion may arise is those who present with pain in the foot due to critical ischaemia but no obvious abnormality to be seen. Palpation of the ankle pulses is an essential part of the clinical examination and absent pulses will immediately lead to the suspicion of limb ischaemia. This can be confirmed by Doppler ultrasound assessment. If the diagnosis of limb ischaemia is not suspected and the pulses are not examined, delay in treatment and an adverse outcome with loss of some or all of the limb may arise. Failure to examine the peripheral pulses could be considered to be substandard management in such cases. Alternative diagnoses may be suspected and treated, such as gout, arthritis and plantar fasciitis. The treatment for these conditions is completely different and will not lead to a satisfactory outcome in a patient with limb ischaemia.

In some instances, ischaemic damage to the limb may give rise to a leg ulcer – a chronic non-healing wound arising from loss of the skin. The location of the ulceration is usually in the calf near the ankle. Leg ulceration is a common problem arising in elderly patients and is often attributable to diseases of the veins rather than the arteries. Varicose veins and previous deep vein thrombosis account for about 70% of leg ulcers. However, in 25 - 30% of patients with a leg ulcer, limb ischaemia will also be a factor. It is essential that every patient who presents with a leg ulcer should be evaluated for lower limb ischaemia by measurement of the ankle:brachial pressure index. It may be impossible to distinguish the clinical appearances of some ulcers between an arterial or venous cause and this is the only reliable way of identifying the presence of arterial disease.

Leg ulceration is a common problem in general practice and district

nurses spend as much as half of their time attending to these. The most common treatment for venous leg ulcers is compression bandaging, an effective treatment leading to healing when used correctly. However, the same treatment applied to an arterial ulcer can be disastrous! The compression bandage may apply a pressure above the arterial blood pressure in a patient with limb ischaemia, completely shutting off the blood flow to the limb. Within hours, irretrievable ischaemic damage is caused to the limb which may necessitate amputation.

Patients with severe limb ischaemia may find a compression bandage intolerable due to the pain and so the district nurse will apply a bandage without compression. In some instances I have encountered, an ischaemic ulcer has been dressed over several months without regard to the underlying arterial problems. Gradually the ulcerated area enlarged, since the blood flow remained poor in the limb, and eventually amputation was required. This would have been avoided had the diagnosis been correctly established before treatment began.

Good nursing practice includes measuring the ankle:brachial systolic index before compression is applied and this is taught to district nurses as a matter of course. Sometimes the district nursing team will seek advice from a 'Tissue Viability Nurse' who will also have expertise in assessing the peripheral circulation. The circulation to the limb should be assessed before any compression bandaging is applied and within a few days of referral to the district nursing team for management of a leg ulcer. Identification of a greatly reduced blood pressure at the ankle should give rise to the suspicion of limb ischaemia with urgent referral to a vascular surgeon within a few days.

### Outcome in cases of delayed diagnosis

In cases where the limb has remained severely ischaemic for an extended period, the region of destroyed tissue gradually extends leading to a reduced likelihood of saving the limb when blood flow is restored. Moderate size ulcers (a few centimetres across) will heal and severely damaged toes can be removed. Extensively ulcerated limbs which have been permitted to develop over weeks or months will not heal and amputation of the limb is the only option.

The outcome of studies of critical limb ischaemia where the correct surgical treatment has been used, show that about 90% of limbs are successfully treated. Some further amputations may also be required over the ensuing years but in most patients the leg can be saved. However, this group has a high mortality rate of 50% at 5 years, arising from the extent of the arterial disease affecting coronary and cerebral vessels leading to death from heart attack and stroke

### Conclusion

Critical limb ischaemia and acute limb ischaemia require expedient treatment if the limb is to be saved. Critical limb ischaemia, giving rise only to pain in the foot or to leg ulceration, may lead to delay in diagnosis unless well established simple methods of assessing the peripheral circulation are used. Palpation of foot pulses and measurement of Doppler ankle pressures should be used in general practice and in hospital where the diagnosis of limb ischaemia is suspected.

A delay in diagnosis of critical limb ischaemia may give rise to progressive destruction of the skin, nerves and muscle of a limb and lead to the need for amputation. Successful restoration of blood flow to an ischaemic limb by a vascular surgeon will lead to avoidance of amputation in 90% of cases. However, patients presenting with severe limb ischaemia have a life expectancy of only 5 years, attributable to arterial disease in other parts of the vascular system. A detailed consensus document has been published which summarises good vascular surgical practice in patients with limb ischaemia. □

### REFERENCES

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**17 years**

Defendant instructions

Claimant instructions

Single joint expert

Court experience

**Areas of experience:**

- Surgery of veins and arteries
- Sclerotherapy & laser ablation of varicose veins
- Varicose veins
- Deep vein thrombosis
- Pulmonary embolism
- Leg ulcer
- Lymphoedema
- Peripheral ischaemia
- Injury to blood vessels
- Medical negligence and personal injury

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