

A multidisciplinary approach to salvaging the 'unsalvageable' foot

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Extensive tissue loss in a weight-bearing area of the foot almost invariably heralds limb loss. We report on a 74-year-old man with diabetes mellitus who had an ischaemic foot that was affected by prolonged pressure, resulting in a necrotic heel. After two sessions of debridement, the calcaneum became exposed. Amputation was initially suggested but was refused by the patient. The foot was subsequently salvaged by staged operations. The first operation was a femoro-anterior tibial bypass using an autogenous saphenous vein to revascularise the foot. This was followed by debridement and attachment of a free subscapular flap to cover the defect performed 2 weeks later by a plastic surgeon. After 85 days of rehabilitation by physiotherapy and education of foot care by a podiatrist, the patient was discharged home and was able to walk with a walking-stick. This multidisciplinary approach avoided an almost certain below-knee amputation.

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Introduction

Extensive tissue loss in a lower limb due to infection and necrosis in the presence of critical arterial occlusive disease almost invariably leads to major lower-limb amputation. It is even more problematic when poorly vascularised tissue such as tendon, bone, and weight-bearing areas are exposed. Vascular reconstruction followed by reconstruction of the soft tissue defect by using microvascular tissue transfer involves covering the non-weight-bearing area with a flap; however, this procedure is rarely performed. We report on the treatment of a patient who presented with extensive ischaemic necrosis of the left heel that exposed the calcaneum.

Case report

A 74-year-old man with non-insulin-dependent diabetes mellitus was admitted to the Department of Surgery at the Kwong Wah Hospital in May 1995. He

presented with gastrointestinal haemorrhage and was initially admitted to another hospital, where he recovered. During the convalescent period, pressure necrosis of his left heel appeared. After the failure of two debridements performed by an orthopaedic surgeon, below-knee amputation was suggested. The patient was reluctant to have amputation and requested to be transferred to the Kwong Wah Hospital. He had previously had peripheral vascular disease, and a femoro-anterior tibial bypass had been performed in January 1995, which had saved his contralateral leg.

On admission to hospital, the patient had a necrotic left heel with half of the calcaneum exposed (Fig 1). The pulses below the femoral artery were absent and the ankle-brachial index was 0.59 (normal value, >0.9). The digital subtraction arteriogram showed that the superficial femoral artery and popliteal trifurcation had been completely obliterated. The only healthy infrapopliteal arteries were the distal half of anterior tibial artery and a segment of posterior tibial artery at the ankle. An amputation was suggested but again the patient refused and accepted the risks associated with major reconstructive surgery.

After consultation with a plastic surgeon, staged operations were planned. A femoro-anterior tibial bypass using an in situ saphenous vein graft was

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Fig 1. Gangrenous heel with exposed calcaneum after two debridements



Fig 2. The same heel after combined vascular and plastic reconstruction

performed to revascularise the foot in the first instance. This was followed by debridement and attachment of a free scapular fasciocutaneous flap to cover the heel defect (5 cm by 9 cm) 2 weeks later. The inflow artery was the posterior tibial artery, which was filled by collaterals from the anterior tibial artery. Four weeks after the operation, the patient started to weight bear and the flap was healthy (Fig 2). The patient was discharged home 85 days after the second operation. During convalescence, the patient received instruction

from a podiatrist regarding foot care. At the time of writing, 26 months after the operations, the saphenous vein graft was patent, the flap was healthy, and the patient was able to enjoy a daily walk without any aids.

Discussion

Patients with non-insulin-dependent diabetes mellitus are liable to suffer from critical lower-limb ischaemia. It has been estimated that 22% of such patients have occult disease compared with 3% of controls.¹ These patients typically have occlusive lesions in the superficial femoral artery, popliteal trifurcation, and infrapopliteal or tibial arteries. In the 1970s, it was suggested that diabetic patients with critical limb ischaemia were not suitable candidates for revascularisation due to the associated microangiopathy.² Subsequently, the thickening in the basement membrane of the small vessels was shown not to impair oxygen exchange.³ These obstructive lesions have recently been shown to be amenable to distal bypass using the autogenous saphenous vein graft to the paramalleolar region, the ankle, and the foot. Recent results also suggest that diabetes mellitus is not an adverse factor regarding the outcome of revascularisation procedures.⁴⁻⁶

Problems that continue to threaten limb salvage arise in large, complex wounds that extend to bones and tendons. Although arterial bypass is possible, amputation is often necessary because it is difficult to provide stable soft tissue coverage. In recent decades, it has been shown that the aggressive approach of combined vascular reconstruction and microvascular free-tissue transfer permit extended limb salvage with excellent functional results.^{7,8} After distal bypass and free-tissue transfer, 90% of patients achieve limb salvage and have 85% ambulation during 32 months of follow-up.⁸

A recent survey conducted by the Hospital Authority Patient-Related Group showed that 206 major amputations were performed for 220 cases of 'diabetic foot' that were associated with critical ischaemia over a 12-month period. Less than 10% of patients were treated with revascularisation procedures.⁹ It would be interesting to know how many of these limb-losing patients had arteriography performed. Nevertheless, this high amputation rate is no longer acceptable in modern-day medical practice. The poor performance might have been due to the lack of vascular surgical support in some Hospital Authority hospitals; it might also have been due to poor communication between the orthopaedic surgeons,

physicians, and surgeons with vascular expertise. The shortage of operating theatre time also may have been a limiting factor for some hospitals. The total operating time for this patient was 13 hours, whereas the time required for a below-knee amputation would have been much less.

In terms of resources and cost-effectiveness, revascularisation is preferable to major amputation. Major amputation costs almost three times as much as successful revascularisation procedures, according to a National Health Service survey from the United Kingdom.¹⁰ In Hong Kong, however, the cost pattern may be different because the patients present at a later stage. The majority of them present with significant tissue loss, which is often complicated by infection. This requires minor amputation and often repeated debridement, even after successful revascularisation. The consequence is prolonged hospital stay with a large wound that is slow to heal. In addition, more than one quarter of the patients presenting to the Kwong Wah Hospital are aged 80 years or more, so the average length of stay is comparable to that of patients who have had major amputation. This could be reduced significantly if the patients were referred earlier, at the stage of rest pain without tissue loss.

As illustrated in this case report, an 'extreme case' of extensive tissue loss can be salvaged, given the right expertise. In fact, up to October 1996 we had performed 91 arterial bypass operations for 83 patients. The overall cumulative limb salvage rate was 84% at 5 years and the hospital mortality rate was 6.6%.¹¹ Surely, more limbs could be saved this way if a good referral system were initiated to maximise the use of the existing vascular support. Communication between the orthopaedic surgeon, diabetic physician, and vascular surgeon should also be promoted so that patients can be referred early to vascular surgeons. In fact, the normal practice in the United Kingdom is that patients with a critically ischaemic foot (ie rest pain with or without ulcer) or gangrene, whether they have diabetes mellitus or not, are first referred to a vascular surgeon or a general surgeon with vascular expertise. The surgeon would select those patients who would benefit from vascular reconstruction. Any patient who suffered from lower-extremity ischaemia with absent foot pulses would be in this category. The presence of a popliteal pulse does not contra-indicate vascular reconstruction because many diabetic patients have tibial disease. Those who require amputation can then be referred to orthopedic colleagues subsequently. Education is also extremely important—that is, how to protect the foot after successful surgery; in this case, the podiatrist played a pivotal role.

With the right support services such as arteriographic imaging, physiotherapy, and a primary health care provider who is trained to deal with vascular patients, the length of hospitalisation and time needed to regain ambulation can be decreased for patients undergoing revascularisation. The long-term survival and quality of life can be improved by obviating the need for major amputation.^{12,13}

Conclusion

Ischaemia-induced ulcer or gangrene in the lower extremity is not uncommon in the ageing population. Major amputation is no longer an acceptable treatment without prior assessment for a limb salvage procedure. Any patient who presents with lower-limb ischaemia in the absence of foot pulses should first be referred to a surgeon with vascular expertise for thorough evaluation. A limb salvage procedure and appropriate after-care may then be offered. The whole process often involves surgeons, an anaesthetist, a physician, a physiotherapist, and a podiatrist. Major amputation should serve only as the last resort in this situation.

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