Composite vascularised osteocutaneous fibula and sural nerve graft for severe open tibial fracture—functional outcome at one year: A case report

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ABSTRACT

Management of severe open tibial fracture with neurovascular injury is difficult and controversial. Primary amputation is an acceptable option as salvaging the injured, insensate, and ischaemic limb may result in chronic osteomyelitis and non-functional limb. We report a case of open tibial fracture associated with segmental bone and soft tissue loss, posterior tibial nerve and artery injuries, which was further complicated by chronic osteomyelitis treated with composite vascularised osteocutaneous fibula and sural nerve graft. Functional outcome of the injured limb at one-year follow-up was satisfactory: the patient was capable of achieving full weightbearing and was able to appreciate crude touch, pain, proprioception, and temperature at the plantar aspect of the foot. There was no pressure sore or ulceration.

Key words: amputation; fractures, open; sural nerve; tibial fractures; treatment outcome

CASE REPORT

An 18-year-old male student sustained an open 3B fracture of the right tibia and fibula, as well as closed fracture of the ipsilateral femur, associated with posterior tibial nerve and artery injuries in a motor vehicle accident.

The patient had wound debridement and external fixator applied, and unreamed nail for the right tibial fracture. The femur was internally fixed. The posterior tibial artery was not repair-
ed primarily as circulation to the foot was satisfactory.

The open tibial fracture had uncontrolled infection, which required multiple and prolonged antibiotic treatment, surgical debridement, removal of the implant, and resection of the infected bone. Following the repeated wound debridement, the tibia became exposed with the presence of a 10-cm bone gap. The patient was then referred to our department.

A composite vascularised osteoseptocutaneous fibular graft and vascularised sural nerve graft was performed 4 months later, in order to bridge the bone gap and to regain protective sensation of the right foot. A pre-operative angiographic assessment showed dominance of the peroneal artery supplying the foot and patency of the anterior tibial artery. The posterior tibial artery was torn (Fig. 1).

A 23-cm long fibula was harvested with cutaneous

![Figure 1](image1) Intra-operative findings of the injured leg: the tibial defect, torn posterior tibialis artery, and neuroma formation of the posterior tibial nerve.

![Figure 2a](image2a) Two months after the surgery: plain radiograph showed that the vascularised fibula graft was fixed intramedullarily by 2 screws, proximally and distally.

![Figure 2b](image2b) One year after surgery: the plain radiograph showed evidence of skeletal union and hypertrophy of the fibula graft.
paddle of 15 x 8 cm in size. The fibular graft was slotted intramedullarily into the tibia and fixed proximally and distally with 2 screws for each side (Fig 2). A 10-cm segmental loss of the posterior tibial nerve was bridged with vascularised sural nerve harvested together with the osteoseptocutaneous fibular graft forming a composite flap. Postoperatively the reconstructed tibia was immobilised with an external fixator.

The infection and graft union were monitored both clinically and radiographically. The infection was satisfactorily controlled and radiological union was seen proximally and distally at 6 months. Full weightbearing was allowed at 10 months postoperatively. The patient had undisplaced fracture of the graft, which was healed with conservative treatment.

Neurological recovery was noted at about 7 months postoperatively and was gradually improving since then. The patient was able to appreciate crude touch, pain, proprioception, and temperature at the plantar aspect of the foot at one year postoperatively (Fig. 3). Soft touch and 2-point discrimination could not be appreciated at the time of writing this report. There was no pressure sore or ulceration.

**DISCUSSION**

Management of severe tibial fracture with neurovascular injury is controversial. Amputation is considered to be more economical and more functional to the patient in the long term, because alternative management of severe open fracture is expensive, time consuming, and the patient is considered as non-functional or disabled during the treatment period. However, decision for primary amputation is difficult, both emotionally and medicolegally. Guidelines for primary amputation were studied to help in decision making. It should also be noted that cases of secondary amputation a few years following salvage surgery were reported.

It is extremely difficult to treat severe open tibial fracture associated with complete injury of both the posterior tibial artery and posterior tibial nerve, the presence of other long bone fracture, and massive bone and soft tissue loss complicated by simultaneous chronic infection. The many problematic conditions associated with our reported case might speak for the choice of amputation.

Most tibial arterial trauma requires immediate repair. Delayed repair was more difficult and was associated with substantial loss of limb. One-tibial vessel injury is associated with 20% risk of amputation. Arterial injury is also associated with delayed, non-union and osteomyelitis. Blunt injury and presence of multiple long-bone fractures were associated with high amputation rate as well. In addition, salvaging a denervated limb usually results in non-functional limb.

Advancement in microsurgery may change the concept of management of severe open fractures. Vascularised osteocutaneous fibula and sural nerve graft composite combined with immediate arterial repair are potentially effective. The advantages of using vascularised sural nerve graft over non-vascularised graft in inadequately vascularised bed have been widely reported.

One year after the procedure, our patient had achieved skeletal union, equal limb length, infection free, recovery of limb function, and acceptable body image. Asians—with unique sociological and religious background—are probably different from westerners in defining a functional limb. The mere presence of the limb means ‘normality’ even though the limb itself may not look normal or is completely non-functional.

Our patient is able to walk full weightbearing (with crutches support for stability), and to participate in recreational activities. Because poorer outcome was reported in older patients with posterior tibial artery injury, better prognosis in young patients with this injury can be expected. However a longer period of follow-up is necessary to evaluate the functional recovery of the limb, as secondary amputation is sometimes required by the patient.
REFERENCES


