Limb conservation using non vascularised fibular grafts

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Summary

This paper highlights the use of non-vascularised fibular graft in limb reconstruction from bone loss due to trauma and infection. Bone loss can occur from severe high velocity injuries due to road traffic accidents, severe neglected infections, and osteolytic tumours.

In majority of cases, the surgeon is left with the only option of an amputation especially where there is no access to microvascular surgery and microvascular bone grafting devices. This is a major problem in the West African subregion hence the need for this article.

We present illustrative cases of limb conservation in an adult involved in a high velocity trauma and a child with a destructive osteolytic infection culminating in bone loss.

The patients are still been followed up in our surgical outpatient clinics.

Keywords: ***Bone loss, Non-vascularised fibular grafts, Limb conservation***

Résumé

Cet exposé souligne l'utilisation de la greffe fibreuse non vascularisée dans la réparation du membre de la perte d'os en raison du trauma et de l'infection.

La perte d'os peut arriver à travers des blessures très grave à cause d'accident de la circulation routière, de la négligence d'une infection très grave, et de la tumeur ostrogothique.

Dans la majorité des cas, le chirurgien ne peut rien faire d'autre que de passer par l'amputation en particulier là ou il n'y a pas le moyen d'avoir accès à la chirurgie micro vasculaire et aux systèmes micro vasculaires de la greffe d'os.

Ceci est un problème majeur dans la sous région de l'ouest de l'Afrique ce qui a provoqué la rédaction de cet article.

Nous présentons les cas illustratifs de la concertions de membre chez un adulte victime d'un trauma bien élevé et chez un enfant atteint d'une infection ostrogothique sévère culminant à la perte d'os.

Nous suivons de près les cas de ces patients dans nos cliniques chirurgicales dans le service des consultation externes.

Introduction

High energy injury to the limb often affects the young in their most economically productive age and sometimes amputation has been the only solution where skin and musculoskeletal loss have been extensive. Bone loss following trauma, infective process or tumour excision can be reconstructed with non-vascularised or micro-scopically revascularised bone transfers.[1] Some authors have reported successful cases of non-vascularised long autologous fibular grafts; however, the lengths of the grafts were not stated.[1-3] Vascularised bone grafts have been advocated in upper limb reconstruction as an alternative to compression-plate fixation and non-vascularised bone graft, when the bone defect is greater than 6cm and in poorly vascularised wounds.[4]

We present two illustrative cases of segmental bone loss due to trauma and infection and reconstructive limb conservation using non-vascularised free fibular grafts.

Illustrative cases

Case 1: A 30 year old, A. O. Hospital number 6741961, right handed male factory worker was admitted through Accident and Emergency Department four days after sustaining an open fracture of both radius and ulna of the right forearm following a road traffic accident. He was initially managed in a Private Hospital before presenting to us. He had Gustilo type III$^{B(6)}$ injury with 10cm-bone loss in the distal radius with marked communition of the articular surface of the radius and distal ulna. There was also dislocation of the distal radio-ulna joint with protrusion of the distal 4cm of the

Fig. 1 ***Gustilo type 3B injury to right radius with significant bone loss.***

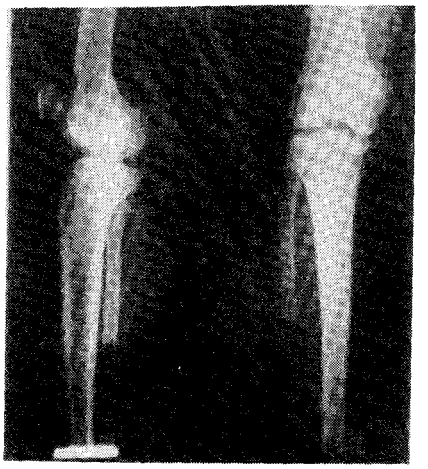

Fig. 2 ***Right fibular showing area of harvested graft***

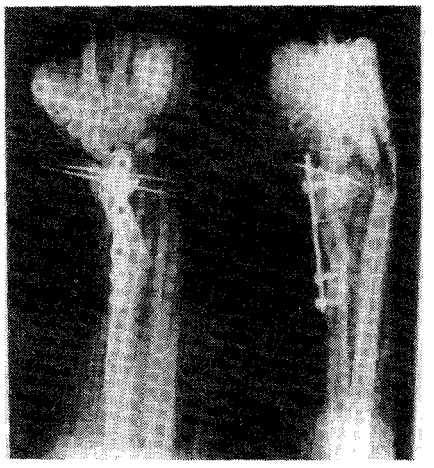

Fig. 3 ***Internal fixation of distal right radial fracture with bridging of bone defect with fibular graft***

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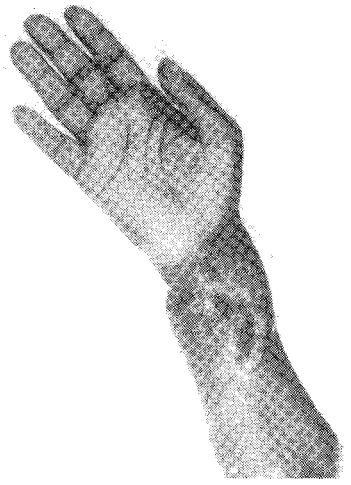

Fig. 4 *Right hand gross appearance after bone and nerve healing*

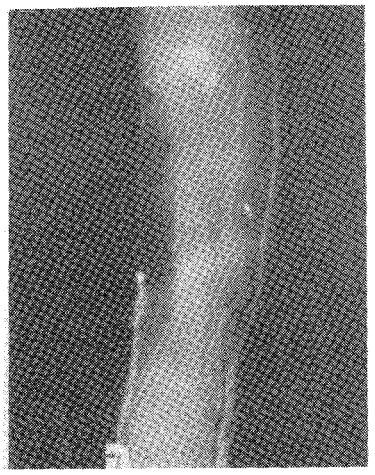

Fig. 5a *Radiograph of left tibia showing proximal tibia defect from infective bone loss*

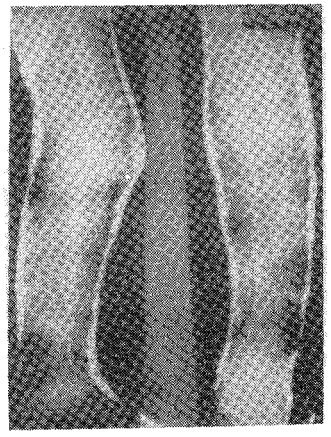

Fig. 5b *Left tibia defect bridged with fibular graft from the same leg*

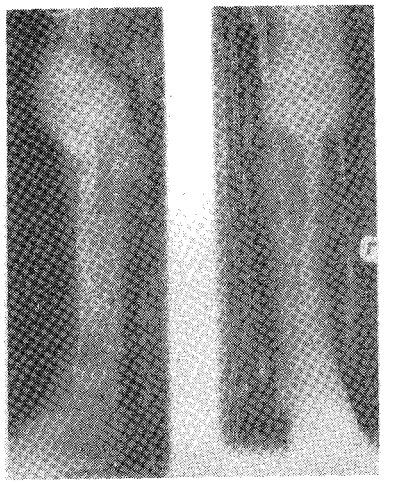

Fig. 5c *Intact left tibia after graft incorporation and bone healing*

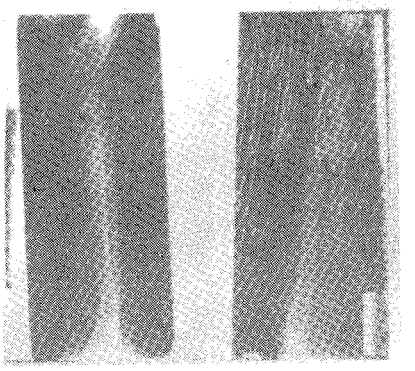

Fig. 6. *Radiograph of the right radius showing evidence of incorporation of the fibular graft*

ulna through the wound. (Fig. 1.). The median nerve was severed with a 4cm gap between its two ends; also severed was the radial artery but the ulna artery was intact.

He had an initial extensive debridement of the right forearm wound, tagging of both proximal and distal ends of the severed median nerve; excision of the necrotic distal ulna and necrotic segmental portion of the radius. He was initially on Rocephin 1 gram daily and later placed, on Ampiclox 500mg 6 hourly, Flagyl 500mg 8 hourly, daily wound dressing and high elevation in the ward.

He had second surgery five days later when wound was clean and healthy. He had a 10-centimeter cortical non-vascularised fibular bone graft which was harvested from the right fibular subperiosteally and used as a strut graft to replace the radial loss. The gap left by the harvested fibular graft was left. Fig. 2 This was held in place with plate and screws and stabilized by Kirschner wire. Fig 3. The sural nerve was approached through the lateral aspect of the right leg using the lateral malleolus as a guideline. The nerve was harvested carefully after being identified and about 6 centimeter of it used to match the median nerve loss. This was preserved in a diluted blood with normal saline till anastomosis was commenced. He also had cable grafting of the median nerve using the sural nerve from the right leg as a donor site. A modified box stitch using the epineurium of the nerves with a 4/0 prolene suture was used. Split-thickness skin grafting of the exposed forearm muscles was performed at the same time. The forearm was supported in below elbow splint and elevated post-operatively.

The post-operative periods were uneventful and follow up radiographs showed satisfactory bone healing. Clinical evaluation at 3 years after injury showed regained sensation to pain and temperature in the median nerve distribution to the right hand and significant function of the right wrist and hand (Fig. 4). The patient can feel pain to both pin prick and blunt object pressure and has since returned back to work as a technical engineer without much functional restrictions in the right wrist or hand apart from the stiffness in his right thumb which he claims does not restrict him from his daily activities. An objective assessment using nerve condition studies has not been made because of lack of the facility for now.

Case 2: 8 year old male, A. T. Hospital number 961168, who had chronic osteomyelitis of the left tibia. He was later on referred to us when the wound did not heal and discovered to have a segmen-

tal bone loss of about 6cm of the tibia and inability to walk on the left lower limb (Fig. 5a). He had Belfast procedures 4 and fibular strut graft from the left leg for the bone defect at the second stage (Fig. 5b).

Presently, he now has an intact tibia and the site of the fibula graft is already healed and patient now mobilizes on (L) lower limb (Fig. 5c).

Discussion

Very few cases of successful autologous non-vascularised bone graft transfers have been reported for the length of the bone defect more than 6cm.[5] The use of a vascularised bone flap has been advocated for this type of injury especially in the presence of precarious vascularity and bacterial contamination[5]. Free autologous non-vascularised fibular graft was however used in our illustrative cases for lack of facilities for microvascular anastomosis with satisfactory outcome. Free fibular graft that was first described for lower limb reconstruction has been found equally useful in the upper limb conservation.[6]

An initial wound debridement, broad spectrum antibiotics, wound dressing and insertion of antibiotics beads (made in our theatre by mixing the bone cement powder to the antibiotic powder the wound swab is sensitive to prior to the surgery) in our second case is quite important in these patients as prerequisite for the preparation of an enabling environment for the survival of the graft.[7] The follow up radiographs showing evidence of incorporation of the fibular grafts confirmed its survival Fig 6. The return of sensation to pain and temperature in the distribution of median nerve and progressive functional improvement are all pointers to the neuromuscular healing.

With this surgical protocol and technique, it has been possible to preserve the limb, reduce deformity, encourage bone healing and improve functional result.

Conclusion

In this environment amputation alone should not be the only consideration in bone loss in upper or lower limbs as it is shown above that autologous non-vascularised fibular grafts can improve limb conservation. However, a careful consideration must be given to the neurovascular status of the limb and the orthopaedic surgeon must be sure of his competence before embarking on this form of limb conservation.

The most essential part of the protocol apart from the skill of the surgeon is adequate debridement of wounds till a healthy vascularised bed is achieved.

References

1. Parker SM, Hastings DE and Fornasier VL: Giant-cell tumour of the distal radius replaced by massive fibular autograft: A case report. Canad, J. Surg. 1974; 17: 266-8.

2. Mack GR, Lichtman DM and McDonald RI: Fibular autografts for distal defects of the radius. J. Hand. Surg. 1979; 4; 576-83.

3. Berggren A, Weiland AJ, Ostrup LT. and Dorfman H: Microvascular free bone transfer with revascularisation of medullary and periosteal circulation or the periosteal circulation alone. J. Bone Joint Surg. 1982; 64A: 73-97

4. Mcnally MA, Small JO, Tofighi HG and Mollan RAB. Two stage management of chronic osteomyelitic of the long bones. The Belfast technique. J. Bone. Joint 1993; 75-B(3), 375-380.

5. Santanelli F, Latini C, Leanza L and Scuderi N.: Combined radius ulna reconstruction with a free fibular transfer. Br. J. Plast. Surg. 1996; 49: 178-182.

6. Gustilo RB.: Current concepts in the management of open fractures. Instr. Course Lect. 1987; 36; 359-366

7. Sakellarides HT: Extensive giant-cell tumour of the lower end of the radius: A report of 1 case treated by resection and replacement with the fibular. Clin. Orth. 1965; 42: 151-6.