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ORIGINAL ARTICLE

IPSILATERAL FIBULA TRANSFERE IN THE MANAGEMENT OF SEGMENTAL TIBIAL DEFECT SECONDARY TO OSTEOMYELITIS: ST LUKE HOSPITAL EXPERIENCE WOLISSO.

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ABSTRACT

Introduction*: Large tibial defects following chronic osteomyelitis present a challenging problem to manage. The aim of the study was to report our experience and outcome of ipsilateral fibular transfer in the treatment of tibial defect due to Chronic Osteomyelitis.*

Materials and methods: *This is a retrospective review of patients who were treated with ipsilateral fibular transfere for large tibial defect due to chronic osteomyelitis between 2008 to 2012.There were nine patients with mean age of 14 years (range 6-34 years).The tibia defect length ranged between 6 and 14 cm with a mean length of 10cm.The outcome criterias were clinical bone union, radiographic union and graft hypertrophy.The transferred fibula was stabilized by a screw or transcalcaneal intramedullary Kistshner wire.*

Results: *Good outcome was obtained in all our patients with mean time to union of 17 weeks (range12-36 weeks).The avearage follow-up time was 3years. Centralized fibula showed union and hypertrophy on radiography. Non-union of distal juction obseved in one patient which was treated with dynamic compresion plate and grafted. Shortening of up to 3cm and mild limitation of ankle range of motion, but all patients were able to ambulate without difficulty.*

Conclusions: *The method was technically simple, easy to perform, short surgical time and does not require microsurgical skills. A use of ipsilateral fibular transposition is a very useful surgical procedure in reconstructing diaphyseal tibia bone defect due to chronic osteomyelitis in resource constrained environment.*

Keywords: *Chronic Osteomyelitis, tibial defect, Ipsilateral fibula transfer.*

INTRODUCTION

Chronic Osteomyelitis is a major health problem in developing country. It is mainly associated with low socioeconomic level. Most of these cases are results of poorly treated acute hematogenous osteomyelitis or neglected due to lack of facility or expertise. In addition to this the condition could also be seen after traumatic injuries or as a complication of surgical procedure. The treatment of chronic osteomyelitis is mainly surgical requiring adequate surgical debridement of necrotic bone tissues and proper antibiotic administration. In most of the cases they present with big sequestration, poor involucrum formation requiring radical surgical intervention which as a consequence often results in large bone defect creating significant morbidity for the patient and threatening the viability of the affected limb (1,2,3).

Tibia is a commonest site of osteomyelitis due to the characteristics of its metaphyseal blood supply and its subcutaneous anatomical location. Secondary bone loss after radical surgical debridement of the necrotic bone is unavoidable.

The clinical management of large segmental tibia defect in association of compromised vascularity, scarring tissue due previous multiple surgical interventions and malalignment of the limb presents a challenging condition for the treating orthopedic surgeon. Different types of surgical procedures have been practiced to manage big tibia defect (2,4 -7).

The use of ipsilateral fibular transfer with its vascular preservation is one of a applicable method for the reconstruction of large segmental tibia bone defects secondary to chronic osteomyelitis. The transfer of the ipsilateral fibula to the tibia defect was first suggested by Hahn in 1884 (6) and later, was used successfully by Huntington in 1903(7). Subsequently, the procedure have been used widely for reconstruction of large segmental tibia defects by several authors in cases of posttraumatic and post-infective, congenital deformity and tumors defects reconstruction (8-12). We describe here tibialization of fibula procedure for the treatment of tibia defect more than 6cm. So, the aim of this study was to report our experience and discuss the outcome of nine consecutive patients who had been treated with ipsilateral fibular transfer in our setting.

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To the best of our knowledge, this is the first report on the outcome of this procedure to treat large tibia defects due to chronic osteomyelitis in Ethiopia.

PATIENTS AND METHODS

This was a retrospective review of nine consecutive patients with segmental tibial defect treated by ipsilateral fibula graft at St. Luke Catholic Hospital, woliso, between 2008 and 2012. These patients were identified from prospectively maintained data. Ethical clearance was obtained from hospital review board. There were seven male and two female with a mean age of 14 years (range 6 - 34 years). Seven patients had chronic hematogenous osteomyelitis of tibia and two patients had post-traumatic osteomyelitis(Table 1).

All were subjected to clinical evaluation and routine laboratory investigations and the X-rays of the affected leg before any surgical intervention. The common clinical presentation were chronic discharging sinuses, exposed bone, varies degree of skin defect over the involved leg and radiologically dead bone (sequestra), pathological fractures and poor new bone formation (figure 1a and figure 2a, b).The duration of the illness was more than three months in all our cases.

The management was provided in two stage protocol. The initial stage of treatment were radical surgical debridement of dead necrotic issues which includes soft tissue, bone and removal large segment of dead bone (sequestrectomy). Dead space resulting from surgical debridement was filled with polymethylmethacrylate (PMMA) beads impregnated with antibiotics (thanks to ORTHOCUAM Italy providing Beads) and temporary immobilization of the limb was provided with plaster of Paris or external fixation. Most of the patients had more than two procedures before fibula graft except one who was presented with large tibia defect without active sign of infection clinical and radiological. All patients have received an antibiotic course at least for 6 weeks.

Following the initial stage of treatment the segmental defect of the tibia ranged from 6 cm to 14 cm (mean 10cm). Through clinical evaluation, laboratory investigations and radiological evaluation was performed to confirm control of infection before bone reconstruction. Common laboratory tests used includes white blood count, erythrocyte sedimentation rate, and hemoglobin level. We did not perform C - reactive protein due to lack of facility. Bone reconstruction stage was proceeded once there is no evidence of persistence of infection clinical and radiological.

Operative technique

The reconstruction was performed after 6- 8 weeks of the last procedure and no evidence of infection clinically as well as on x-ray evaluation was noticed. We used separate incisions for both tibia and fibula. First, the tibia was exposed through the previous surgical scar, antibiotics beads removed, both proximal and distal ends of defects were identified, adequately exposed the ends, medullar canal well seen, freshened, and the gap was measured. Thru a lateral incision the fibula was exposed subperiosteally, above the level of proximal tibia segment and distal tibia segment.

The muscle and neurovascular structures in the anterior compartment were retracted anteriorly and the fibula was shifted into the defect of tibia and stabilized with two to three 4.5 mm cortical screws or cancellous screws in three patients and intramedullary Kirschner wires in six cases (figure 1b &2c). The fibula was incorporated near to normal axis of the tibia and into medullary canal to allow biological and mechanical advantage for healing. None of the junctions were bone grafted primarily. The wound were sutured by layer and a long leg plaster cast was applied with the knee in slight flexion and the ankle in neutral position. Drainage was left in situ for 48 hours.

Post-operatively patients were instructed not weight bear for the first eight weeks then after progressive protected partial weight bearing was allowed based on radiological evidence of bone union and a long leg circular cast was changed to patellar bearing cast. Full weight bearing was encouraged once good healing was observed on both anteroposterior and lateral radiography.

During the follow up period all cases were regularly evaluated clinically and radiologically for bone union. Complications like nonunion, recurrence of infection, implant failure, fracture of transposed fibula were assessed. The knee, ankle range of motion, limb length discrepancy and others associated deformities were also assessed.

RESULTS

Bone healing was observed in all our cases. The mean duration of healing was 17 weeks (range 12-36 weeks). The patients were followed from 2 to5years after fibular transposition with mean follow up 3 years (range 2 - 5 years).

One patient developed nonunion in the distal junction and was managed using dynamic compression plate (DCP) with bone graft and sound union achieved. He was the only adult patient we had. Shortening of 3cm noticed in one patient and while in others shortening were not significant. Axial alignment overall was good. All our case had good range of motion the knee joint with mild stiffness of ankle joint.

The transferred fibula showed hypertrophy in all nine patients (Figure1c) and (Figure 2b). No flare up of infection noticed in any of cases during the follow up period. No patient had compartment syndrome or neurovascular damage. All were able to resume their day to day activities and routine work.

Table 1: Clinical details and results for the patients treated with ipsilateral fibular graft

Cases	Age(yr)	Gender	Cause	Defect	Time of union
1	6	M	Hematogenous osteomyelitis	6cm	12weeks
2	13	F	Hematogenous osteomyelitis	10cm	18weeks
3	15	M	Post-traumatic osteomyelitis	12cm	20weeks
4	12	M	Hematogenous osteomyelitis	9cm	14weeks
5	11	M	Hematogenous osteomyelitis	12cm	13weeks
6	11	M	Hematogenous osteomyelitis	14cm	14weeks
7	13	F	Hematogenous osteomyelitis	13cm	15weeks
8	8	M	Hematogenous osteomyelitis	8cm	12weeks
9	34	m	Post-traumatic osteomyelitis	10cm	36weeks

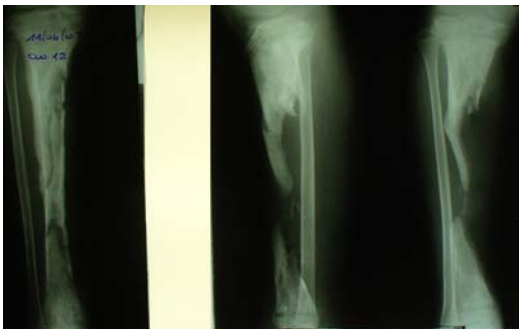


Figure 1a: preoperative X-ray of leg showing Chronic osteomyelitis of tbibia with sequestrum and tibia defect following sequestrectomy

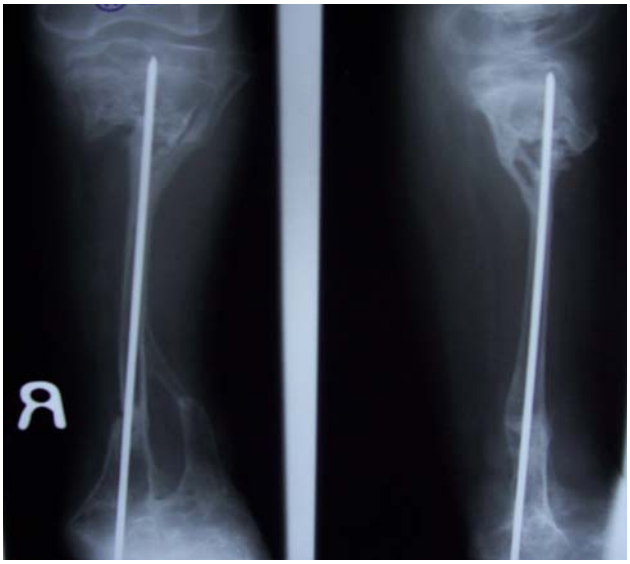
b c

Figure 1b: Radiograph showing tibialiazation of fibula fixed with screw (c) healing with fibular hypertrophy

A

B

Figure 2a: Picture shows exposed bone with discharge and
b: Plain radiograph showing dead bone of tbia with pathological fracture



C

D

Figure 2c:Plain radiograph showing reconstruction of segmental tibia defect with ipsilateral fibular graft and fixed with Kirschner wire.

DISCUSSION

Large tibia defects due to chronic osteomyelitis are common in developing countries especially in children due to inadequate management and late presentation. It represent a challenging problem for the treating surgeon and patients (1, 2, 6, 10). The basic principles in the treatment of any long bone infection is based on radical debridement of all compromised tissue, early provision of vascularized soft tissue cover with elimination of dead space followed by delayed reconstruction (2,3,13,17). Different types of surgical procedures have been used to treat large defect of tibia, which includes free vascularized fibula graft from contra lateral leg, non-vascularized fibular graft and Ilizarov technique.

The use of Ilizarov procedure it is believed to be a time-consuming surgical technique with high rate of complications and prolonged external fixation time. In addition availability of fixator and expertise is another concern in developing countries like Ethiopia (4,14). Vascularized transafer of fibula from the contra lateral leg creates further morbidity to the normal limb, is a prolonged surgical procedure, needs microsurgical expertise with special equipment and has high rate of fatigue fracture (5, 10,15). The use of non-vascularized fibular graft from contra lateral leg is often limited by risk of nonunion, high incidence of stress fracture, and infection and donor site morbidity (16).

The use of ipsilateral fibula transfer to treat large tibial defect have been used by several authors both in children and adults with good outcome (7-9,17-19). The transposed fibula ensures continued vascularization of the graft in a poorly vascularised fibrotic bed. The transfer of a large graft of fibula raised on a pedicle of peroneal and anterior tibial muscles and peroneal vessels, and fixing the graft to the tibia along its posterior long axis proximally and distally, produces a sound mechanical and biological advantage for union. Chacha and his colleages on their experimental and clinical studies have shown the viability of ipsilateral fibular graft and reported good outcome in all their cases (2, 17).

We had good outcome in salvaging the limbs in all of our patients by using ipsilateral fibular graft. The healing of both junctions proximal and distal was obtained in all our patients with sound hypertrophy of transferred fibula. The transposition of fibula to the proximal and distal tibia segment was performed in one stage reconstruction in all patients fixing with screw or intramedullary K-wire stabilization through calcaneus maintaining as much as possible anatomical axis of the limb. We preferred one stage reconstruction procedure because all our patients had good skin condition with minor scar tissue and free of infection. Huntington in contrast performed the procedure in two stage to enhance the healing process (7).

We believe one stage reconstruction avoids risk of repeated surgery, hospital stay and cost effective. Similarly Tuli used single stage procedure to reconstruct the tibia defect by fixing the fibula into long axis of the leg to provide biological and mechanical advantage of healing (18). According Agiza the fibula undergoes hypertrophy and it becomes an integral part of the static supporting architecture of the leg when it is subjected to weight bearing stress (8). Similar observation noticed in all our patients. Shortening of the limb was noticed with mild ankle stiffness, but functional limitation was not significant and was compensated by shoe raise. This is probably related to growth plate damage of the tibia as the consequence infection in our pediatric cases. Similar finding was reported in other studies (2, 20).

Several other studies have reported their success by this procedure to treat large tibial defect due to different causes (9, 11, 18-20). Kassab et al emphasized the importance infection control, good skin condition and stable nutritional status for successful fibular transposition (12).

The use of ipsilateral fibula transfer provides varies benefits. The procedure does not require specialized reconstructive technique and instruments. The transfer of large segment of fibula with its vascular supply and muscle attachment provides excellent condition for good healing and infection control. The procedure is limited to the same limb side, so that contra-lateral donor site morbidity is avoided.

The Transference of ipsilateral fibular graft for the treatment of large tibia bone defect due to chronic osteomyelitis is an important choice for salvaging the limb. The Surgical technique does not require special skill and implants to perform. It is technically easy with short operative time and hospital stay. There is no donor site morbidity compared to vascularized fibular transfer from contra lateral leg and it can be performed in resource limited setup. For better outcome the treating surgeon should have due consideration of good soft tissue condition, presence of infection, and socioeconomic factors.

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Competing of interest

There is no conflict of interest**.**

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