Use of Fibula Bridge Graft Technique to Treat a Distal Tibia Non Union- A Case Report

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Abstract

Introduction: Compound distal tibia fractures have high incidence of nonunions and have varied presentation as far as status of fibula is concerned. If fibula is sufficiently healthy we can use it for bridging the nonunion of tibia.

Case Report: We present a case of 20 year old female with compound and segmental tibia fracture. Primary stablisation by external fixation and later cast brace application achieved union at the proximal end of the segmental fragment with non union at the distal end. This was then treated with bridge grafting of fibula and screw fixation of fibula to the tibia. Five years follow shows good clinical and functional outcome without any complications.

Conclusion: Its infrequent to find fibula spanning across the tibia nonunion, however when available this can be used as bridge graft to promote healing.

Keywords: Fibula Bridge Grafting, Tibia Nonunion, bone grafting.

Introduction

Distal tibia is common sites of aseptic non unions and delayed unions, especially in compound wounds with extensive soft tissue injury [1,2]. These are difficult to treat and various techniques are utilized to treat these fractures. Two factors dictate the further management in aseptic cases, mobility at fracture site and healing response from the bone. In cases with fibrous union or a stiff non union only bone grafting with immobilization may be adequate to achieve union.3 In cases with abnormal mobility an internal fixation is required. Intramedullary nailing is used in cases with sufficient distal fragment to offer rigid fixation [4,5]. Compression plates can be used for angulated distal fractures; and ring fixators are preferred in cases with bone loss [6]. In certain cases, specially with poor local skin condition, distal fibula can be used to bridge the nonunion tibia site and provide advantage of both bone grafting and internal fixation. Such use was first described in 2005 by James and Santrock in an abstract presented at foot and ankle surgery course 2008 [7]. We describe successful use of similar technique in non infected tibia nonunion in 20 year old male.

Case Report

Our case was a 20 year old female with road traffic accident. An informed consent was taken from her for publication purposes. Her left leg was crushed under a truck tyre and she presented with a grade IIIb compound fracture tibia with a 20cm by 8 cms wound over the anteromedial side of lower third of tibia, extending over to the medial side of ankle joint and foot. Periosteum was seen exposed in lower third of tibia and wound was badly contaminated. Radiographs of the leg showed a distal third tibia fracture with a segmental piece of tibia which

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was further comminuted. The fibula fracture was at the same level as tibia and was short oblique fracture. Patient presented immediately after the injury and debridement was done within 2 hours of injury. A thorough wash was given with debridement of all dead and devitalized tissue. Fracture was fixed using a biplanar external fixator (Fig. 1). Wound dressing was done regularly and intravenous broad spectrum antibiotics were given. Two further debridements were needed and at 4 weeks the wound was healthy enough to perform a cross leg flap. At 3 weeks post flap surgery, the external fixator was removed due to multiple pin track infections and the limb was immobilized in a long leg cast. At 3 and half months post injury the wound was healthy. Radiographs showed that the segmental tibia fragment was showing good union response at the proximal end; however the distal end appeared to be rounded with attempt to callus formation which is non bridging (Fig. 2). Abnormal mobility at the fracture site indicated a need to stabilize the fracture, however soft tissue condition precluded any form of internal fixation. At that time the fibula fracture was completely united. A decision to do a posterior bone grafting along with bridge fibula grafting was taken to provide additional stability at the non union site. Lateral approach was taken and cancellous graft taken from the same side (right) iliac crest was filled in the interosseous membrane between tibia and fibula by at the site of the fracture, just proximal and just distal to it. Two 3.5 mm cortical screws were passed from the fibula to into the tibia at the site where the graft ends proximally and distally. This was done to make a rigid strut with cancellous graft in the middle (Fig. 3). Patient was put in a long knee brace and advised non-weight bearing for a period of 8 weeks. At two months after bridge grafting good callus was seen bridging the fracture and the patient was given a patella tendon bearing cast and was started on partial weight bearing. Complete union was achieved at 7 months post surgery. The ankle movement was 10 degree dorsiflexion from neutral and 20 degree plantar flexion from neutral position at that time. Patient resumed her activities at 8 months post trauma while screw removal was done at 18 months post injury. The patient was last followed up at 5 years post injury. She was walking full weight bearing and was able to carry out all her activities. The medial soft tissue scar was healthy. Ankle dorsiflexion was restricted to 10° but the plantar flexion was around 50° (Fig. 4). There was no history of pain or discharge from the injury.
site. The radiograph showed the fracture outline to have a silhouetted appearance with good union on posterior and medial side with good consolidation of the entire area of the bridge graft between tibia and fibula (Fig. 5).

**Discussion**

Bridge grafting of fibula has limited indications but can provide initial stability and achieve good cross union between the bones. Only one such case is described previously and present case demonstrates the usefulness of bridge grafting which should be kept in mind in such cases with complicated bony and soft tissue injuries.

Tibia fibular synostosis has been first used by Milch in 1939 [8]. He performed posterolateral cancellous bone grafting between tibia and fibular creating a cross union between the bones. After him many have reported the success of this method; however the indication is limited to fibrous nonunions with limited mobility and no requirement of additional stability [6]. In cases where additional stability was required transfer of ipsilateral fibula by osteotomy at both ends and fixation of the fibular strut graft across the non union is reported. This is similar to Huntington procedure which was done in two steps [9-11]. In our case the non union had abnormal mobility and thus stabilization was required. This could have been achieved by an intramedullary nail, however an additional open procedure for bone grafting and bone graft harvesting would have been needed. Another option was internal fixation using a compression plate, however the soft tissue envelope on the medial side was very thin to allow any surgery on the medial side. A ring fixator could have helped the patient with compression at the fracture site and bone grafting, however issues with pin tracts for which the external fixator was removed would have again raised problems. With these options and problems with them, we tried the concept of bridge grafting as described by James and Shr [7]. A similar concept was utilized by Weinberg et al to fill up defect in war injuries [12]. They however osteotomised the fibula at one end. In our case the fibula was united in slight angulation towards the tibia thus we could utilized the fibula as an internal fixation device without osteotomy. We fixed the fibula at ends across the non union site, which acted as the working of bridge grafting which should be kept in mind in such cases with complicated bony and soft tissue injuries. Additional bone graft in the interosseous space consolidated over a period of time to form a stable tibia fibular synostosis. Reckling and Waters commented that formation of this synostosis facilitates tibia union and also does not affect the knee and ankle joint in long term [3]. At 5 years follow up the patient was fine with good union and was able to ambulate independently. The limitation of dorsiflexion may be requirement of additional stability [6]. In cases where procurvatum at the tibia union site. This did interfere in squatting; however patient modified her activities accordingly.

**Conclusion**

Thus in conclusion in non union tibia, use of fibula bridge graft with interosseous cancellous graft may be an option in select cases like one described here. Careful selection of patient should be considered while making a clinical decision and in select cases good results can be expected within limits of the local biological potential.
Clinical Message
Distal fibular nonunions are commonly seen however it is infrequent to find fibula spanning across the tibia nonunion. When such scenario presents the described technique can be used as bridge graft to promote healing. Single case report highlighting this technique and philosophy is presented here.

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