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# TREATMENT OF GAP NONUNION OF TIBIA BY THE HUNTINGTON FIBULAR TRANSFER PROCEDURE: A CASE REPORT

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**ABSTRACT** **Background:** Complex Gap non-unions of the tibia following infections or trauma is a treatment challenge with an unpredictable outcome. Amputation often is considered in these cases, which is not always acceptable to the patients. Major tibial defects required the help of modern techniques of fracture stabilization and soft tissue& bone reconstruction. Various techniques have been described in the literature for the treatment of gap non-unions such as bone transport, bone grafting, induced membrane technique, allograft reconstruction and Huntington procedure (ipsilateral transposition of the vascularized fibula) each having its own limitation.

**Case Presentation:** An 11-year-old boy attended our OPD presenting with gross swelling of the right tibia following chronic infection to the bone. After debridement of the infected bone, there was an extensive gap between the ends of the tibia. Using Huntington's procedure; the ipsilateral fibula was shifted to tibial defect and fixed with screws. Additional fixation was provided with the help of an external fixator. After a brief period of guarded weight-bearing, it was noted that the fibula hypertrophied and was completely incorporated into the tibia.

**Conclusion:** Huntington procedure is simple and technically easy for large tibial defects. It does not require microsurgical skills and implants. The union of the transferred fibula is faster than conventional graft as it is a vascularized graft. It is a rational choice for the treatment of large tibial defects in selected cases.

**KEYWORDS :** Gap non-union, bone-loss tibia, segmental defect, Tibialization, Huntington's procedure

## INTRODUCTION –

Gap nonunions of the tibia are not uncommon and present an enormous challenge to both the orthopaedic surgeon and the patient. In the past, cases with wide bone loss following severe injuries or infections often required amputation. Today, with the advent of modern surgical techniques such non-unions can now be salvaged [1]. However, attempting limb reconstruction in the presence of significant bone loss usually involves surgery that is technically difficult, time-consuming, physically and psychologically demanding for the patient with no guarantee of a satisfactory outcome. The problems also involve bridging or regenerating areas of bone loss while maintaining limb length and alignment [2]. Nonunion of the tibia with infection, bone loss, or both represent a complicated scenario and is better managed with a vascularized fibular graft, free fibular graft or bone transport [3, 4]. Transposition of the ipsilateral fibula to the tibia was suggested by Hahn in 1884 [5] and was first used successfully by Huntington in 1903 to fill a 12.7cm tibial defect in a 7-year old boy [6]. The technique which we describe here involves the relocation of the fibula to the tibia as a pedicle graft in a single staged procedure. Due to the preservation of blood supply to one end of the fibula, the graft readily takes up and hypertrophies upon weight bearing over a period of time [7].

We report a case of an 11-year-old boy who presented with a segmental defect resulting from chronic osteomyelitis involving the right tibia.

## CASE REPORT

An 11-year-old boy was referred from a local private hospital to our OPD. He presented with gross swelling of the tibia which was initially bandaged in a concoction of herbs. Following a detailed history, it was revealed that the child belonged to a low socio-economic upbringing and hailed from a remote hamlet with no access to modern medicine. He had been treated for a month by a traditional healer for a mild discharge from a wound on his leg. By the time he sought help from us, gross swelling of the leg associated with discharging sinus is seen. We set about by the application of an external fixator of the affected leg and performing excision of the extensive diaphyseal sequestrum. The length of the defect was maintained by an external fixator and then the ipsilateral fibula was harvested. The head of the fibula and lateral malleolus were marked and a line was drawn along the posterior border of the fibula along the posterior crural inter-muscular septum. Distal osteotomy site was at least 5 cm above the projection of the lateral malleolus (to maintain ankle stability) and proximal osteotomy site at 2 cm below the neck of the fibula was marked. Next the flap was raised with the standard technique of free microvascular flap; except peroneal vessels were not divided. The fibula was then osteotomized at both ends with preservation of the peroneal vessels and was shifted in the tibial defect to be placed in intramedullary space and fixed with screws. Additional fixation was provided with the help of an external fixator in cases of trauma and Ewing's sarcoma while in Pseudoarthrosis tibia the internal fixation with plate was done. Concomitantly, the child's overall nutrition was improved with the help of the hospital dietitian. Postoperatively, the Patient's leg was immobilized by an external fixator for 3 months followed by an above-knee cast for 6 weeks and then PTB cast for another 6 weeks. Partial weight-bearing was allowed by PTB brace. Healing of the transferred fibula was evaluated radiographically using anterior-posterior (AP), lateral and oblique views of the affected leg. Apart from the healing process complications such as a fatigue fracture/angulation of the fibula was also monitored. Immobilization in the external fixator/cast continues until the radiographic union is evident, usually by 14 weeks post-surgery.

**Fig1:** Radiographs Of The Involved Limb During Admission, Anteroposterior And Lateral Views.

**Fig 2:** Vascularized Fibula Raised On Peroneal Pedicle

**Fig 3:** Defect In The Tibia

**Fig 4:** Fibula Placed In The Tibial Defect

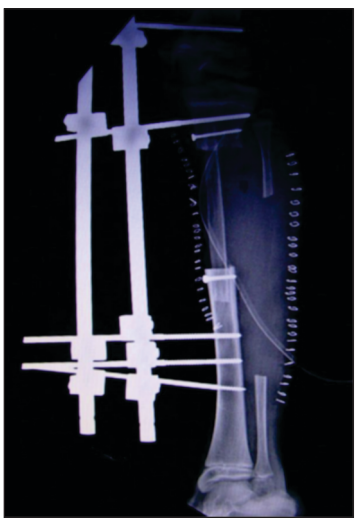

**Fig 5:** Immediate Postop X-ray

**Fig. 6.** Tibialization Of Fibula After 6 Months.

## DISCUSSION

Treatment of major bone gaps is demanding and if the patient is not willing for prolonged treatment then amputation remains the only option. Modern methods of bone replacement enable one to reconstruct any degree of bone loss[8] but the severity of the soft-tissue loss and the insensate foot is the most important reason for considering the amputation. The initial cost for amputation is considerably less compared to limb salvage, but in long run, the costs of maintenance of prostheses are considerably more than for a successful reconstruction.[9,10] Significant segmental defects of tibial defects can be treated by conventional bone grafting/Papineau technique, allograft reconstruction, bone transport using the Ilizarov frame, contralateral free vascularized fibular and transport of the ipsilateral fibula (Huntington procedure). All of these techniques have their pros and cons. The conventional bone grafting/Papineau technique is useful for smaller defects with good vascularity and absence of infection. However, bone graft has limited mechanical strength and takes a long time for union and weight-bearing.[11] Reconstruction with bone allograft is not feasible due to the absence of a bone bank. Moreover, bone allograft may be associated with a high risk of failure, infection, rejection, fracture, and nonunion.[12] Most surgeons prefer bone transport with the Ilizarov technique for large tibial defects, but in many cases, the tibial remnant is inadequate for lengthening. Additionally longer healing time with a significant pin track infection and bulky ring frame may not be tolerated by some patients.[13] Contralateral vascularized fibula requires microvascular expertise and may lead to ankle pain/instability, peroneal nerve injury, and progressive valgus deformity.[14] Transposition of the ipsilateral fibula to the tibial gap was first proposed by Hahn in 1884 and later used successfully by Huntington in 1903.[5,6] Huntington and Catagni transferred fibula in two stages while Tuli described single stage end to end apposition of the fibula.[15,16] The length of fibular available for transfer is 20-24 cm; sparing 2 cm at the upper end to prevent injury to the common peritoneal nerve and 6 cm at the lower end for the stability of the ankle joint. In the leg, the tibia is the main weight-bearing bone and the fibula act as a strut for muscle attachment and provide stability to the ankle joint.

Fibula transmits only 15% of body weight and almost 70% of the fibula shaft can be used for transfer.[17,18] We transferred the fibula in one stage and placed it intramedullary. It reduces the risk of fracture as the graft falls in the line of the mechanical and anatomical axis of the tibia. This is in contrast to the technique by Huntington which places the graft posterior or medial to the tibia.[19,20] The vascularized fibula heals by primary bone healing and does not require creeping substitution as occurred in non vascularized grafts. It has all the advantages of the vascularized fibular graft without the need for microvascular expertise.[21] The fibula has abundant blood supply from the nutrient branch of the peroneal artery and surrounding muscle attachments which lead to early union and good vascularity to wash out the infection. This is also the basis behind Huntington procedure for gap non-union.[22] Therefore fibula is a good choice to reconstruct tibial defects as it has good mechanical property and its ability to get hypertrophied.[6] Fibula when subjected to continuous mechanical load; has immense potential to undergo remodelling and hypertrophy (Wolfe's Law).[23] The indications for Huntington's procedure are gap non-union of the tibia (due to trauma, tumour, pseudo-arthrosis and osteomyelitis) with scarring, presence of infection, severe soft tissue injury, malalignment of the limb and failure of conventional techniques. The management of gap nonunion of the tibia in the above-mentioned scenario is difficult by conventional methods like bone transport, auto/allografting, distraction osteogenesis and microvascular surgery. The contraindication of Huntington's procedure includes fracture of the fibula at multiple levels and loss of peroneal vessels by trauma. Huntington procedure has the advantages of using fibula as a biological implant for internal fixation implants at a site vulnerable to infection and non-union. The fibula is firmly secured to the tibia maintaining the length of the limb and restoring its alignment. Fracture of tibialized fibula and valgus deformity of the ankle is uncommon.[24] It is a single-stage surgery, independent of recipient bed, faster union, and good stability with no contralateral limb donor site morbidity. The limitations of the procedure include primary applicability in young patients because the rate of union is faster and the hypertrophy is maximum in younger patients.[22]

## CONCLUSION

Huntington's procedure still holds a distinctive place for salvaging gap nonunions of the tibia, especially in paediatric patients. Tibialization

of the fibula is a simple, cost-effective and easy procedure that can be performed in any moderately equipped hospital.

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