

Tibial bone loss of 13 cm treated by Ilizarov Distraction Osteogenesis

Gautam Shah¹, N B Goyal², Sameer S. Patil³

Abstract:

Background- Open tibial fractures of Grade III B (Gustilo-Anderson classification) with extensive bone and soft tissue loss can lead to painful non-union and chronic sepsis. This may pose difficulties which may require amputation at a later time. Deciding the modality of treatment for such extensive injuries is still a topic of debate. The application of distraction osteogenesis with a conventional Ilizarov frame has reduced the need for amputations in such cases.

Materials and Methods: We are reporting a similar case of compound # tibia, GA III B with 13 cm of bone loss, treated in a stepwise manner with distraction osteogenesis using conventional Ilizarov ring fixator along with skin grafting under antibiotic coverage. Complete union was obtained with fusion at the docking site at 7 months without any complications like infection, refracture, knee or ankle contracture or any neurovascular deficit.

Results: Though patients' compliance is a major contributing factor considering a ring fixator; good preoperative psychological evaluation and explanation of the procedure to the patient gives excellent results in compound fractures where bone loss is > 10 cms.

Key words: Ilizarov ring fixator, distraction osteogenesis, Gustilo-Anderson classification, open tibial fractures.

Introduction

Treatment of long tubular bone defects was and still continues to be one of the most difficult problems in orthopaedic surgery[1]. Prolonged time of treatment for such injuries leads to disruption of all aspects of the patient's life. Open tibial fracture, GA III B with more than 10 cms of bone loss, extensive soft tissue and periosteal injury can develop into painful non-union and chronic sepsis. This leaves amputation as the only choice left for the surgeon.

A technique developed by Proff. Ilizarov in 1956 called "Distraction Osteogenesis" where circumferential subperiosteal corticotomy is done at the metaphysis and the fragment is distracted slowly over the Ilizarov ring fixator results in new bone formation at the corticotomy site. This method was earlier used for limb lengthening but now it is also used to eliminate the gap at the site of the bone loss [2].

Distraction osteogenesis with the Ilizarov ring fixator allows to correct the bone defect along with soft tissue repair and infection. This simultaneously reduces the span of treatment giving excellent results and early rehabilitation for the patient.

Case Report

A 40 year old male came to our emergency department with an open tibial fracture which was graded as Gustilo-Anderson Type III B fracture.

After confirmation of peripheral pulses and any neurological deficit emergency debridement was done. A long bone fragment was observed to be necrotic and was removed. An external fixator was applied for initial stabilization of the limb. Patient was evaluated with routine blood investigations and radiographs. The bony defect was 13 cm with the open wound measuring 14cm X 15cm [Figure 1, 2, 6]

After immediate debridement and stabilization with an external fixator, Ilizarov ring fixator was applied with 3 rings [Figure 7]. Circumferential subperiosteal corticotomy with osteotome was done in the proximal metaphysis about 3cm distal to the patellar tendon. Stepwise distraction at the rate of 1 mm per day was started after 7 days at the corticotomy site. Simultaneously infection was treated with antibiotics and wound care. Skin grafting was carried out after the infection subsided [Figure 3].

Touch weight bearing was initiated at 2 weeks. Partial weight bearing was started at 3 weeks and full weight bearing at 6 weeks after application of ring fixator. Complete bone loss was filled at 4 and half months after distraction was started.

After removal of all fibrous tissue developed at distal fragment, docking of proximal over distal fragment [Figure 9] was done followed by compression for 5 weeks, After which the Ilizarov frame was dynamised and patient was allowed full weight bearing

¹Department of Orthopaedics, ACPM Medical College, Dhule, India.

Address for correspondence:

Dr. Sameer S. Patil,
Junior Resident, Department of Orthopaedics, ACPM Medical College and Hospital, Dhule
Email- sameer15789@gmail.com



Fig 1: On admission, during Debridement



Fig 2: Separated dead bone fragment of 13 Cms



Fig 3: After application of Ilizarov's Fixator and skin grafting



Fig 4: Follow up at 2 yrs, sitting cross leg

for 1 week on the dynamised frame following which the framewas removed.Partial weight bearing was continued for 4 weeks after removal of fixator before full weight bearing was allowed.

During distraction and compressionthe patient stayed in the Rehabilitation department under constant observation and supervision. After discharge, the patient had to follow up monthly, for evaluation of clinical and radiological progress.

A stepwise proceeding of the 7 months of treatment is mentioned in Table 1.

Discussion

Tibial diaphysis is the most common site of bone loss due to its subcutaneous position predisposing it to open fractures. Considering such major injuries historically amputation was preferred.Since the advancement of different promising modalities like distraction osteogenesisas described by Ilizarov in 1958, the incidence of amputations has been substantially reduced.

The first decision to be made is whether to follow limb salvage procedure or amputation. This depends on the

neuro-vascular status of the limb, general status of the patient, resources and future prognosis. An important thing to be considered is debridement and curetting the devitalized bone and soft tissue further extends the severity of injury and bone loss.

The aim of the treatment in such injuries is restoration of limb length, stabilization and simultaneously treating the infection for early rehabilitation. The Ilizarov ring fixator allows simultaneous treatment of bone loss along with treating soft tissue damage and infection.

Mechanically the Ilizarov ring fixator can be a preferred device to be used in such injuries as McCoy, Chao and Kasman compared various types of external fixations for their mechanical properties in 1983 where they proved that the Ilizarov fixator has the lowest overall stiffness but high resistance to antero-posterior stress .It allows axial compression forces to act on fracture site making it a dynamic osteogenesis system allowing early mobilization. Also the weight bearing contact between the fracture ends probably stimulates bone regeneration[3].

Other treatment options which can be considered for such types of injuries are lengthening over nail, plating over free fibular graft, autogenous cancellous bone



Fig 5: Followup at 2 yrs, standing



Fig 6: Xray, On admission



Fig 7: X ray, after application of Ilizarov's Fixator on day 1

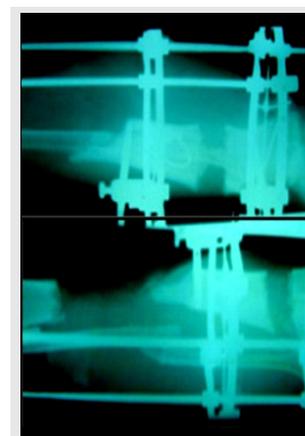


Fig 8: X ray, during distraction osteogenesis, at 5th week

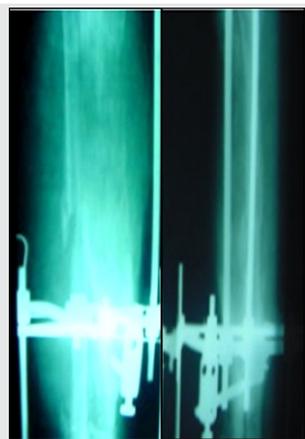


Fig 9: X ray,during docking, at 19th week



Fig 10: X ray,After solid union at 7 months

grafts with or without external fixator, the Papinau technique - a spacer with a prosthesis but with functional limitations. In such methods due to longer span of treatment, time is a major disadvantage and contraindicated during persistent infection. [4,5,6] Also they are technically more demanding, there is a risk of failure of vascular anastomosis in free fibular grafts, and prolonged protected weight bearing is needed which prolongs the rehabilitation [7]

Though a long period of application of the Ilizarov fixator may be considered as a small disadvantage, it doesn't pose a major problem in practice and rehabilitation of the patient can be started early [8]. Preoperative counselling and detailed explaining of the procedure to patients and their relatives or caregivers improves compliance towards adaptation, giving better results. At times, refractures, delayed union, limb length discrepancy, axial deformity, joint stiffness, pin track infection and difficulty in adapting to the ring frame may be the complications need to be dealt with. [9].

Amputation as the final alternative treatment should be considered only when patients' resources are not sufficient or in any suspected high chances of complications.

Conclusion

Patients' compliance is a major contributing factor considering the Ilizarov ring fixator; good preoperative

psychological evaluation and explanation of the procedure to the patients gives excellent results in compound fractures where bone loss is > 10 cm.

Clinical Message

Ilizarov's ring fixator with Distraction osteogenesis will help reducing the need for amputation

References

1. Hani E.M, Mona M. (2005) The effect of low-intensity pulsed ultrasound on callus maturation intibial distraction osteogenesis. *International Orthopaedics (SICOT)* 29:121-124
2. Ilizarov GA, Ledyev VL. (1992) The replacement of long tubular bone defects by lengthening distraction osteotomy of one of the fragments. *ClinOrthop* 280:7-10
3. McCoy MT, Chao EYS, Kasman RA.(1983) Comparison of mechanical performance in four types of external fixators. *Clin.Orthop.* 180:23-33
4. Cierny G, Zorn KE (1994) Segmental tibia defects: comparing conventional and Ilizarov methodologies. *ClinOrthop* 301:118-123
5. Green SA (1994) Skeletal defects: a comparison of bone grafting and bone transport for segmental skeletal defects. *ClinOrthop* 298:111-119
6. Johnson EE, Urist MR, Finerman GAM (1988) Repair of segmental defects of the tibia with cancellous bone grafts augmented with human bone morphogenetic protein: a preliminary report. *ClinOrthop* 236:249-257
7. Keating JF, Simpson AHRW, Robinson CM (2005) *J Bone Joint Surg Br.* 87-B:142-50.
8. Paley D, Chaudhry M, Pirone HM, Lentz P, Kautz D (1990) Treatment of malunions and mal-nonunions of the femur and tibia by detailed preoperative planning and the Ilizarov techniques. *OrthopClin North Am* 21:667-691
9. Dahl MT, Gulli B, Berg T (1994) Complications of limb lengthening. *ClinOrthop* 301:10-18

Conflict of Interest: Nil
Source of Support: Nil

How to cite the article: Shah G, Goyal NB, Patil SS. Tibial bone loss of 13 cms treated by Ilizarov Distraction Osteogenesis. *Journal of Trauma & Orthopaedic Surgery.* July - Sep 2015; 10(3):25-27