

# Study of Management of Open Type IIIa and Type IIIb Fracture of Tibia by Limb Reconstruction System

Sandeep Pangavane<sup>1</sup> and Gaurav Kapandis<sup>2\*</sup>

<sup>1</sup>Professor & Head, Department of Orthopaedics, Dr. Vasantao Pawar Medical College Hospital & Research Centre, Nashik - 422003, Maharashtra, India; drsandipangavane@gmail.com

<sup>2</sup>PG Resident, Department of Orthopaedics, Dr. Vasantao Pawar Medical College Hospital & Research Centre, Nashik - 422003, Maharashtra, India; gauravnazi@gmail.com

## Abstract

**Background:** Management of compound tibia and femur fractures is difficult due to the presence of infection, bone loss, shortening and multiple surgeries in the past. Open wound of lower limb are traditionally managed by Ilizarov fixation. The disadvantages of Ilizarov are poor patient compliance, inconvenience of the frame and difficult frame construction. We conducted a study on 20 compound tibia and femur fractures treated by the limb reconstruction system (LRS).

**Method and Materials:** A prospective analysis of compound fracture of tibia type IIIa and IIIb was done, cases treated from Jan 2012 to June 2016 were included, which were treated with LRS application. This patient who had a minimum period of 6-24 month follow up from the day of initiation of treatment. 10 cases of compound tibia IIIa and 10 cases of IIIb were included in study. Status of wound was classified by Gustillo-Anderson open wound criteria, comorbidities were noted, additional procedure if any were noted. Radiological union was defined as minimum of 3 cortical continuity in views of X-Ray. Time duration was recorded in which knee range of motion was assessed by 'hand goniometry' during treatment.

**Result:** Average age of patient was 37.9 year, tibia showed total 100% fracture united. Average time tibial union was 10.2 month. Average time for tibial LRS in situ was 10.6 month. 6 patients required corticotomy with lengthening. Average lengthening was 2.5 cm in 7 no cases (1.5-5 cm range). Average knee ROM is 100 degree of flexion (range 90-130). Complications noted were

- 1) pin tract infection
- 2) Delayed or Non union
- 3) multiple surgeries
- 4) patients co-operation

**Keywords:** Management, Open tibia fracture, Limb reconstruction system

## 1. Introduction

Open fractures of tibia with massive soft tissue injury and bone loss, has become a problem for all trauma surgeons.

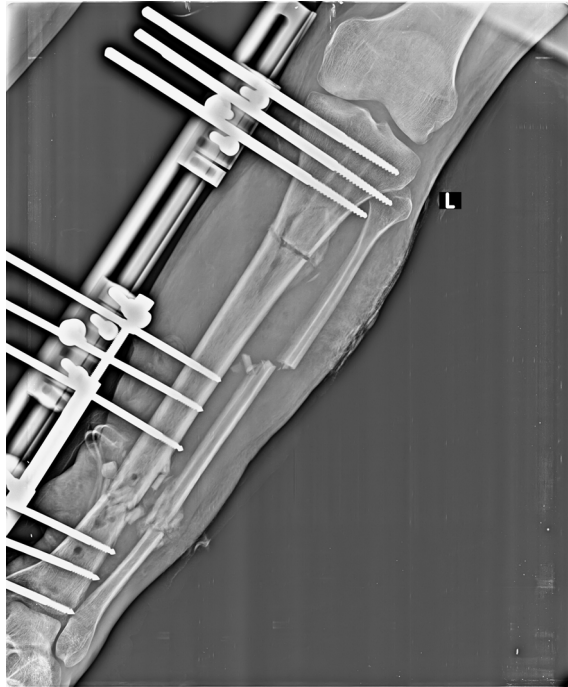
<sup>1</sup> The specific method of treatment of these fractures is a matter of debate, with the treatment options ranging from external fixator, ring fixator, nailing, plating, tibial synostosis, free or vascularised bone grafting along with Allograft or bone substitutes, all having their own set of complications<sup>2,3,4</sup>. Treatment for infected fracture of the tibia with bone loss include debridement, external fixation and bone grafting, micro vascular composite tissue transfer, and bone transport through an external

fixator<sup>7,8,9</sup>. It is increasingly popular, as it can correct deformities, regenerate new bone without bone grafting, correct limb-length discrepancy, avoid prolonged antibiotic therapy, and enable weight bearing during the course of treatment<sup>10</sup>. LRS can do most of these procedures in a single stage can cause patient less burden of multiple surgical sittings.<sup>11</sup>

## 2. Aim of study is

- 1) Measure the time interval to achieve union with LRS in situ

- 2) To measure the time duration for which LRS has to be kept in situ to achieve union
- 3) To study complication and assess its reasons
- 4) To assess knee range of motion at roll of treatment with ability to bear weight



**Figure 1.** Corticotomy day 1.

### 3. Material and Method

This is prospective study of 20 patient from Jan 2012 to June 2016 in Dr. Vasanttrao Pawar medical college Department of Orthopaedics and Tertiary Care Centre. Patients of age group 15 – 70yrs irrespective of gender, with radiologically diagnosed tibia and femur fracture according to Gustello-Anderson classification in which 20 patients are open tibia fracture in which 10 patients are IIIa and 10 of type IIIb, commonest mechanism of injury being road traffic accidents. Once the patient is haemodynamically stabilized, clinical evaluation, primary wound debridement with copious amount of normal saline done and Open Fractures were classified according to Gustello-Anderson's classification as Type IIIa and type IIIb is further be more precise to determine the rate of infection and prognoses. Also 9 patient was already operated in which 5 external fixator, 3 tibia interlock, and 1 tibia plating was done, which was removed due to the infection and open wounds. Application of LRS external fixator was carried out such that it should be away from the site of wound. If a soft tissue coverage

procedure is required, then railing application should be applied such as to leave enough area for the soft tissue procedure intended. compression distraction technique was started at 1 mm for every day; 0.25mm four times in a day, after the immediate postoperative corticotomy (Figure - 1). Later adequate soft tissue coverage was done with 4 with primary closer, 9 with skin grafting, 3 pedicle flap, 1 rotational flap and 2 free flap, one with gastronemious flap. Clinical and radiological assessment done with due importance to the pin tract infection and presence of callus. Once there is a radiological signs of fracture healing, patients were allowed to bear weight on toes with aid of walking frame or crutches and joints were mobilized. radiological union was defined as minimum of 3 cortical continuity in views of x-ray. time duration was recorded in which knee Range of motion was assessed by 'hand goniometry during treatment. kept the LRS according to union on radiological evaluation. after union LRS clamp was loosen for 3 weeks and then applied PTB cast for 4-6 weeks with full weight bearing (Figure - 2).

The inclusion criteria :-

1. compound IIIa and IIIb fractures of tibia
2. Patient willing to give written informed consent

Exclusion criteria:-

1. All pathologically fractures
2. Vascular and nerve injury



**Figure 2.** LRS removal ap view.

## 4. Result

The results are assessed in 20 patients. 10 patients are open tibia fracture IIIa and 10 type IIIb. The patients were between 18-66 years of age out of which maximum number of patients were in the age group of 20-40 years. RTA was the cause of injury in all of the cases. patients underwent split skin grafting and flap repair, all soft tissue transfers were successful in our series. 7 patient needed proximal corticotomy and lengthening and equal limb length was achieved. only one patient showed shortening after limb lengthening more than 2 cm. Common complication in our study was pin tract infection<sup>12,13,14,15,16,17,18</sup>, were treated with suitable parenteral antibiotics after culture and sensitivity. 100% of the fractures united well. knee range of motion more than 100 degree is in 14 patient with shoe raise in one patient because of open tibia and femur fracture with bone loss. all patient shows full weight bearing walking with squatting, cross legging.



**Figure 3.** LRS removal x ray lateral view.

## 5. Discussion

Open fractures of the tibia with bone loss have been a problem every trauma surgeon has to encounter. The conventional methods of treatment like nailing or fixator with acute docking had a high rate of complications including bone loss leading to shortening, soft tissue

healing problems, increased morbidity, multiple surgeries and longer hospitalization and nonunions<sup>19,20,21,22,23,24</sup>. LRS is a safe, reliable device provides adequate initial stability, gives an excellent easy accessibility for the management of soft tissue injuries, and early reconstruction of the soft tissue with a flap to cover the exposed bone significantly reduces the risk of infection, non union and amputation. Average age of patient was 37.9 year, Range from 18-66 year, Tibial 100% united. Average time tibial union was 10.2 month. Average time for tibial LRS in situ was 10.6 month. 7 patient required corticotomy with lengthening. Average lengthening was 2.5 cm in 7 no cases (1.5-5 cm range). Average knee ROM is 100 degree of flexion (range 90-130).

LRS uses osseous callus distraction for bone lengthening in a variety of procedures such as bone transport, simultaneous compression and distraction at different sites, monofocal lengthening, bifocal lengthening and correction of deformities with shortening.



**Figure 4.**

## 6. References

1. Whittle PA, Wood II GW. Fractures of lower extremity. 10th Ed. In: Campbell's Operative orthopedics, Canale TS, ed. Philadelphia: Mosby Publications; 2003. pp. 2761-7.
2. Blachut PA, Meek RN, O'Brien PJ. External fixation and delayed intramedullary nailing of open fractures of the tibia



- shaft. A sequential protocol. *J Bone Joint Surg Am.* 1990 Jun;72(5):729-35.
3. Reuss BL, Cole JD. Effect of delayed treatment on open tibial shaft fractures. *Am J Orthop* 2007; 36(4):215-20.
  4. McGraw JM, Lim EV. Treatment of open tibial shaft fractures. External fixation and secondary intramedullary nailing. *J Bone Joint Surg Am.* 1988 Jul;70(6):900-11.
  5. Maurer DJ, Merkow RL, Gustilo RB. Infection after intramedullary nailing of severe open tibial fractures initially treated with external fixation. *J Bone Joint Surg Am.* 2005;87:142-50. [PubMed]
  6. Maurer RC, Dillin L. Multistaged surgical management of posttraumatic segmental tibial bone loss. *Clin Orthop Relat Res.* 1987;216:162-70. [PubMed]
  7. Keating JF, Simpson AH, Robinson CM. The management of fractures with bone loss. *J Bone Joint Surg Br.* 2005;87:142-50. [PubMed]
  8. Cole JD, Ansel LJ, Schwartzberg R. A sequential protocol for management of severe open tibial fractures. *Clin Orthop Relat Res.* 1995;315:84-103. [PubMed]
  9. Krappinger D, Irenberger A, Zegg M, Huber B. Treatment of large posttraumatic tibial bone defects using the Ilizarov method: A subjective outcome assessment. *Arch Orthop Trauma Surg.* 2013;133:789-95. [PubMed]
  10. Ajmera A, Verma A, Agrawal M, Jain S, Mukherjee A. Outcome of limb reconstruction system in open tibial diaphyseal fractures. *Indian journal of orthopaedics.* 2015 Jul;49(4):429.
  11. Robert Rozbruch S, Weitzman AM, Tracey Watson J, Freudigman P, Katz HV, Ilizarov S. Simultaneous treatment of tibial bone and soft-tissue defects with the Ilizarov method. *J Orthop Trauma.* 2006;20:197-205. [PubMed]
  12. Sen C, Kocaoglu M, Eralp L, Gulsen M, Cinar M. Bifocal compression-distraction in the acute treatment of grade III open tibia fractures with bone and soft-tissue loss: A report of 24 cases. *J Orthop Trauma.* 2004;18:150-7. [PubMed]
  13. Mekhail AO, Abraham E, Gruber B, Gonzalez M. Bone transport in the management of posttraumatic bone defects in the lower extremity. *J Trauma.* 2004;56:368-78. [PubMed]
  14. Donnan LT, Saleh M, Rigby AS, McAndrew A. Radiographic assessment of bone formation in tibia during distraction osteogenesis. *J Pediatr Orthop.* 2002;22:645-51. [PubMed]
  15. Bumbasirevic M, Tomic S, Lesic A, Milosevic I, Atkinson HD. War-related infected tibial nonunion with bone and soft-tissue loss treated with bone transport using the Ilizarov method. *Arch Orthop Trauma Surg.* 2010;130:739-49. [PubMed]
  16. Wani N, Baba A, Kangoo K, Mir M. Role of early Ilizarov ring fixator in the definitive management of type II, IIIA and IIIB open tibial shaft fractures. *Int Orthop.* 2011;35:915-23. [PMC free article] [PubMed]
  17. Atef A, El-Tantawy A. Management of open infected comminuted tibial fractures using Ilizarov concept. *Eur J Orthop Surg Traumatol.* 2014;24:403-8. [PubMed]
  18. Watson JT, Anders M, Moed BR. Management strategies for bone loss in tibial shaft fractures. *Clin Orthop Relat Res.* 1995;315:138-52. [PubMed]
  19. Maurer RC, Dillin L. Multistaged surgical management of posttraumatic segmental tibial bone loss. *Clin Orthop Relat Res.* 1987;216:162-70. [PubMed]
  20. Keating JF, Simpson AH, Robinson CM. The management of fractures with bone loss. *J Bone Joint Surg Br.* 2005;87:142-50. [PubMed]
  21. Cole JD, Ansel LJ, Schwartzberg R. A sequential protocol for management of severe open tibial fractures. *Clin Orthop Relat Res.* 1995;315:84-103. [PubMed]
  22. Korkala O, Antti-Poika I, Karaharju EO. External fixation in open fractures of leg. Analysis of traps and complications of the method. *Rev Chir Orthop Reparatrice Appar Mot.* 1987;73:637-42. [PubMed]
  23. Tropet Y, Garbuio P, Obert L, Jeunet L, Elias B. One-stage emergency treatment of open grade IIIB tibial shaft fractures with bone loss. *Ann Plast Surg.* 2001;46:113-9. [PubMed]