

# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## Definitive Management Of Open Lower 3<sup>rd</sup> Tibial Fractures With Primary Limb Reconstructive System.

K Ramesh<sup>1\*</sup>, P Radhakrishnan<sup>2</sup>, and S Kumar<sup>3</sup>.

<sup>1</sup>Senior Assistant Professor, Department of Orthopedics, Government Dharmapuri Medical college and Hospital, Tamil Nadu, India.

<sup>2</sup>Associate Professor, Department of Orthopedics Government Dharmapuri Medical college and Hospital, Tamil Nadu, India.

<sup>3</sup>Associate Professor, Department of Orthopedics, Government Dharmapuri Medical college and Hospital, Tamil Nadu, India.

### ABSTRACT

To determine the efficacy of Limb Reconstruction System for treatment of compound lower 3<sup>rd</sup> tibial fractures. A prospective study was carried out where in 20 cases having Modified Gustilo Anderson Type IIIA and IIIB lower 3<sup>rd</sup> tibia fractures with a mean age of 42±5 years were treated using LRS over a period of 12 months. Bony and functional assessment was evaluated based on classification system of treatment by Olerud & Mollander et al. Among 20 patients, objective results as per score were excellent in 15, good in 2, fair in 2 and poor in 1 patient. Subjective results were excellent in 14, good in 3, fair in 2, poor in 1 patient. The average fracture union time was 4 months. Post surgery patient satisfaction was excellent since fixation allowed weight bearing immediately. LRS is an alternative to the traditional system of fixation in the primary management of open fractures of long bones. It is less cumbersome to the patient and more patient friendly in terms of reducing financial burden also. It is a definitive single implant procedure.

**Keywords:** tibia, fractures, reconstruction.

<https://doi.org/10.33887/rjpbcs/2024.15.3.59>

*\*Corresponding author*

## INTRODUCTION

Distal metaphyseal fractures of the tibia with or without intra articular fracture extension in adults are among the most problematic injuries to treat. The most important variables that affected the final clinical result are the type of fracture, associated soft tissue injury, the method of treatment and the quality of the reduction [1,2]. Conservative treatment of these fractures quite often results in a number of complications including malunion, non-union and ankle stiffness. Conventional plate osteosynthesis with open reduction can further devitalize fragments and lead to higher incidence of non-union, infection and implant failure. Operative treatment is indicated for most tibial fractures caused by high energy trauma. Operative treatment allows early motion, and avoids shortening and other complications associated with prolonged immobilization. The fundamental goal of treatment of distal tibial fractures is restoration of normal or near normal alignment and articular congruity and finally to obtain a well healed fracture; pain free weight bearing; and functional ROM of ankle joint. For the past decade, plating has been successful in treating complex fractures of the lower extremity especially distal tibia [3]. To improve fracture healing, more “biological” methods have been developed in the last decade to lessen the surgical dissection, preserving blood supply to bony fragments and containing at least partially the fracture haematoma. Locking compression plate for treatment of fractures of the distal part of the tibia in open Grade 1 and 2 but in case of grade 3 fractures there is comparatively an increased chance of complications.

External fixation can be used as either a temporary or definitive method of treatment, especially in fractures with severe soft tissue injury (open grade III) but malunion and Nonunion problem of these method of fixation. Usually, a sequential protocol of treating compound fractures are initial debridement, external fixation, closure of the wound, internal fixation. The infection rate of fractures which were first treated by external fixation and then with internal fixation was significantly much higher than those fractures treated with internal fixation alone [4]. A high incidence of infection is noted secondary to the delayed internal fixation and the need for several procedures. So, we resorted to external fixator to continue as definitive management. Limb Reconstructive System (LRS) is a unilateral frame with half pins being simple, effective, offers rigid stabilization of fracture fragments and an access to soft tissue care reducing the economic burden and obtains maximum benefit. Technique of LRS External fixation has emerged as an definitive treatment option for open distal metaphyseal tibia fracture. When applied externally, LRS does not endanger periosteal blood supply, respect surrounding soft tissues, provides biomechanically stable construct and technically less demanding method of fixation [5].

This study was conducted with the objective to assess the efficacy, union rates, limb lengthening, postoperative mobilization and the complications associated with the use of LRS in distal 3<sup>rd</sup> open tibial fractures.

### Inclusion Criteria

Patients between 18-60 years of both the sexes with Compound 3A &3B fractures of tibia.

### Exclusion Criteria

Immediate life-threatening conditions, Closed fractures, old fractures (>4 weeks) Severe Osteoporotic fractures

## MATERIALS AND METHODS

20 prospective cases of open fractures of long bones with or without bone loss treated by using the LRS to achieve union or lengthening simultaneously constituted the study. Their clinical and radiological evaluation will be done at presentation and certain specific intervals and evaluated for signs of bone union, functional assessment and complications. The study was conducted at our hospital for a period of 24 months from 2021-23.

### Operative Technique

#### Open fracture without bone loss

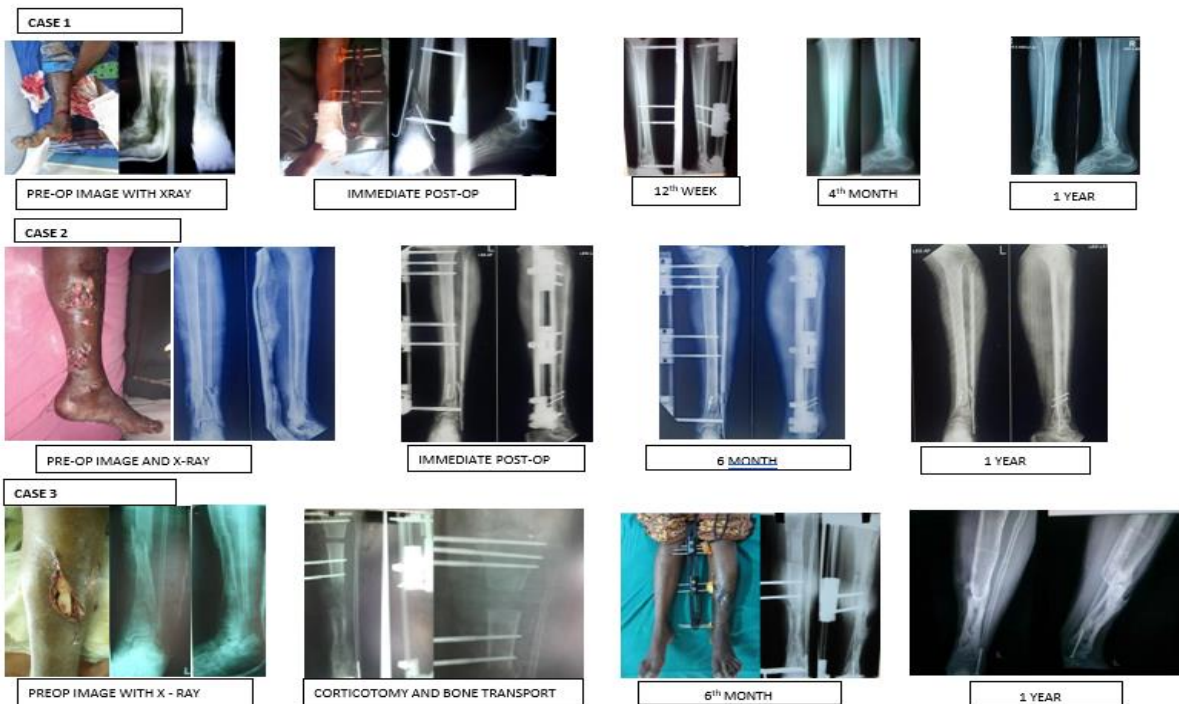
The open fracture on presentation is applied splintage and antibiotics are started immediately. In

the OT, the wound is debrided and fracture is reduced & temporarily fixed with K-wire or short DCP plate which is removed at end of surgery. The required length of rail of LRS along with minimum one template clamp (if possible two) on either side of fracture is taken. Double sleeve is taken and two Schanz screws are inserted in proximal most & distal most holes of template clamp on either side of fracture. The Schanz screws close to joint should be parallel to joint line. Then Schanz screws are inserted closest to fracture site at distance of 2.5 cm (minimum) from fracture site. The remaining Schanz screws are then inserted. The template clamp is then replaced with final clamp. Nuts are tightened with Allen key and compression distraction union is applied across fracture site. While inserting Schanz screw proximal cortex is drilled with 4.8 mm & far cortex with 4 mm drill bit. Then 5/6 mm Schanz screw is passed. There should be minimum three Schanz screws on either side of fracture. These Schanz screws are best passed in 1, 3, 5 position hole of clamp. If only 2 Schanz screws are being placed in a clamp, they are best placed in 1, 5 position of LRS frame is applied on anteromedial side of leg. The wound cover in form of primary closure or SSG or flap cover is done as per requirement of wound in same sitting within 5 days.

**Open fracture with bone loss**

In operative technique, the wound is debrided and fracture is aligned. Rail length is selected and three template clamps are taken. Corticotomy site is preplanned and Schanz screws are passed into all three clamps using above principles. Each clamp should have minimum 2 Schanz screws at 1, 5 (ideally 3 at 1, 3, 5 position). The template clamp is replaced by final clamp and nuts are tightened. The corticotomy is performed as planned and compression distraction unit (CDU) is applied. Distraction is started after 7 days of surgery. Postoperative protocols are adjacent joint mobilisation started on 1<sup>st</sup> post operative day. Non weight bearing with walker started on 3<sup>rd</sup> to 5<sup>th</sup> post operative day. Partial weight bearing started after 4-6 weeks.

Fixator removal was done after radiological and clinical union at fracture site (4 -5 months).



**RESULTS AND ANALYSIS**

Functional outcomes were evaluated based on classification system of treatment by Olerud & Mollander et al. All Patients were followed up at regular interval i.e. 1 month, 3 months, 6 months, 12 months, 18 months and 24 months.

**Objective Criteria**

| Rating    | Ankle/Subtalar Motion | Tibiotalar Alignment | Tibial Shortening | Chronic Swelling | Equines Deformity |
|-----------|-----------------------|----------------------|-------------------|------------------|-------------------|
| Excellent | >75% normal           | Normal               | None              | None             | None              |
| Good      | 50-75%                | Normal               | Minimal           | Minimal          | None              |
| Fair      | 25-50%                | <5 angulation        | Moderate          | Moderate         | None              |
| Poor      | <25%                  | >5 angulation        | Severe            | Severe           | Present           |

**Subjective Criteria**

| Rating    | Pain     | Return To Work | Recreational Activity    | Limited Walking | Pain Medication | Limp       |
|-----------|----------|----------------|--------------------------|-----------------|-----------------|------------|
| Excellent | None     | Same Work      | Normal                   | No              | None            | None       |
| Good      | Mild     | Same Work      | Mild modification        | No              | None            | None       |
| Fair      | Moderate | Modified       | Significant Modification | Yes             | Non-narcotic    | Occasional |
| Poor      | Severe   | Unable         | None                     | Yes             | Narcotic        | Yes        |

**Objective Results**

| Results   | No. Of Cases | Percentage |
|-----------|--------------|------------|
| Excellent | 15           | 67%        |
| Good      | 2            | 13%        |
| Fair      | 2            | 13%        |
| Poor      | 1            | 7%         |

**Subjective Results**

| Results   | No. Of Cases | Percentage |
|-----------|--------------|------------|
| Excellent | 14           | 80%        |
| Good      | 3            | 13%        |
| Fair      | 2            | 7%         |
| Poor      | 1            | 0%         |

**Complications**

To basic principles and use of proper technique can keep complications to a minimum.

**Pintract Infection**

7 cases, most of them superficial infection, treated with local care and oral antibiotics. Realignment of pin done for 2 cases under LA.

**Joint Stiffness**

3 cases, knee and ankle joint stiffness treated with passive stretching and active mobilisation exercises.

**Delayed Union**

4 cases, 2 cases managed by dynamization, 2 cases managed by additional surgery with bone grafting.

**Non-Union**

1 case of non-union, presented with co-morbidities such as peripheral vascular disease, Diabetes

mellitus with alcohol and tobacco abuse, which are known to be associated with complications of bone healing, and treated with bone grafting.

## DISCUSSION

Fractures of the open distal tibia were among the most difficult fractures to treat effectively. The primary goal of operative treatment is to anatomically align the fracture fragments while providing enough stability to allow early motion [6-11]. This study was chosen to determine the efficacy of functional outcomes, mono-lateral LRS External fixation in the treatment of the open distal tibial metaphyseal fractures.

The treatment of Open distal metaphyseal fractures of the tibia by closed intra-medullary nailing or using plates may be associated with complications such as malunion, non-union, secondary loss of reduction, wound dehiscence, local septic complications and stiffness of adjacent joints. LRS external fixation of these fractures is technically feasible and advantageous in that it minimises soft tissue compromise and devascularisation of the fracture fragments. Even though early intervention is advantageous, it is desirable to do surgery even in the presence of gross local swelling, external wound and infection. Our aim was to return the patient to full function as soon as possible and not make the patient to undergo several operative procedures and burden the poor patients economically in which LRS external fixation can be used as primary and definitive line of management for open fractures distal tibia which is very cost effective [12-22].

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. Resection of devitalized bone, simultaneous compression of the fracture gap or site and secondary limb lengthening by proximal corticotomy and compression and distraction techniques can be accompanied with the LRS external fixator with low rates of infection and non-union. Open fractures are surgical emergencies, one of the basic goals of treating open fractures is to prevent deep infection. LRS External fixation has been the skeletal stabilization of choice with the lowest reported deep sepsis rates with relatively high rate of fracture union, pin tract infection, malunion, and non-union have complicated its use but most complications can be successfully managed without frame removal. The method of application of the mono-lateral fixator is simple with better patient compliance and exposure to fluoroscopy is very less.

It is not essential to fix fibular fractures in the presence of a simple fracture pattern of the tibia provided the fibular fracture is proximal to the syndesmosis. However, any fibular fracture at the level of, or distal to the syndesmosis, with comminution of the distal tibia requires stabilisation to maintain the lateral column of the ankle thereby preventing late collapse and secondary loss of reduction. 12 fibular fractures were in the distal segments, and were operated by K Wire, Malleolar screw and plate, whereas the other 8 were in the proximal and middle part were treated conservatively. Up to 4 cases had Medial malleolar fractures (MMF), which were fixed by malleolar screw and K Wire. Also, some patients were treated by bone grafting, bone transport, SSG and Flap cover when needed. In our study all the cases got primary bone union. Bone union with Objective results were 15 excellent, 2 good, 2 fair and 1 poor and Subjective results were 14 excellent, 3 good, 2 fair and 1 poor. The mean length of time in healing for all patients was 4.5 months. The most common complication was pin tract infection and ankle stiffness. We can conclude that the treatment of open grade III distal tibial metaphyseal fractures with an LRS using technique is a reliable definitive method of stabilization.

In a study conducted by Edward in 1988, Grade III open tibial fractures were treated with external fixator, where in 93% of the fractures united well and 89% patients had satisfactory clinical function.

According to a study done by Ajmera et al., LRS proved to be an effective modality of treatment in cases of open fractures tibia with bone loss as definite modality of treatment for damage control as well as for achieving union and lengthening. It decreases the incidence of complications of soft tissue damage and bone healing associated with the conventional methods of plating of these fractures. Intra-medullary nailing, though biological, suffers from a limitation of inadequate fixation due to a small distal fragment, even more so in the presence of comminution [23-30].



## CONCLUSION

According to this study, 20 patients with fractures of the open grade 3 distal tibia which have undergone LRS External fixator techniques and application of this technique has resulted in the strong and effective stabilization of these fractures. It does provide excellent stability and allows early range of motion at ankle and also in rapid union, because it facilitates preservation of the blood supply to the fragment and helps to achieve near normal anatomical reduction of the fracture. LRS external fixator gives an excellent accessibility for the management of soft tissue procedures like skin grafting, myocutaneous flaps and reduces the risk of infection, non-union and amputation mean time lessening the economic burden on the patient.

In the distal third tibia, due to its subcutaneous location and sparse blood supply and poor muscle coverage, fracture healing is difficult and, in such cases, LRS external fixator is quite useful.

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