

## Unilateral external fixator as the primary and definitive treatment modality in type IIIB open tibial fractures: A retrospective study

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### Abstract

**Introduction:** Intramedullary (IM) nailing is considered the method of choice for treatment of closed diaphyseal fractures of the tibia. However, there is controversy in the literature regarding the best way of managing open type III B fractures. The aim of this study was to evaluate the effectiveness of unilateral external fixator as primary and definitive treatment for Gustilo and Anderson compound grade III B open tibial fractures.

**Materials and Methods:** This was a retrospective case series of patients with Gustilo and Anderson compound grade III B open tibial fractures treated in our institution from Jan 2010 to May 2014. All the cases that were treated with unilateral tubular external fixators within 24 hours of injury were included. Serial debridement and early coverage if required, was done within seven days. Dynamisation and partial weight bearing was started at 8-10 weeks on observing early signs of fracture healing. Weight bearing with patellar tendon bearing cast was permitted at 12-16 weeks, on visualization of bridging callus and continued till radiological and clinical union.

**Results:** There were 31 males (83.7%) & 6 females (16.2%) with Gustilo IIIB fractures with a mean age of  $37.43 \pm 8.92$  years and a standard error of 0.55. The commonest mode of trauma was road traffic accidents followed by fall from height & direct trauma to the limb. All the patients were operated in emergency within 24 hours with debridement of wound and primary external fixation. The average time to union was  $22.13 \pm 2.68$ , superficial pin track infection occurred in 11 cases & deep infection leading to loosening of Schanz screw was seen in two patients. Delayed union was seen in two patients whereas, non-union was seen in three patients requiring secondary procedures.

**Conclusion:** The results show that unilateral external fixators can be used as primary and definitive treatment for compound type IIIB tibial shaft fractures with satisfactory outcomes. These are particularly helpful in resource limited setups, where the operating surgeons may not have a wide range of implants and instrumentation at their disposal owing to low financial profile of patients.

**Keywords:** External fixation, Definitive treatment, Open tibial fractures, Gustilo Anderson type IIIB.

### Introduction

Tibial shaft fractures are the commonest open fractures of long bones owing to the anatomic location & precarious soft tissue coverage.<sup>1,2</sup> Intramedullary interlocked nailing is considered as gold standard for the treatment of close diaphyseal & Gustilo Anderson type I, II & most of IIIA fractures of tibia, however, in compound IIIB fractures, there are conflicting results in literature making it a grey area with no clear defined guidelines.<sup>3-6</sup> The treatment modalities in such fractures are, primary intramedullary nailing (unreamed), external fixation followed by intramedullary nailing & primary external fixation as a definitive treatment.<sup>2,6</sup> The incidence of infection in fractures which were first treated by external fixation and then with IMIL nailing was considerably much higher than those fractures treated with Primary IM nailing.<sup>4,6</sup> A high rate of infection coupled with repeated surgeries adds further to the misery especially in the resource limited countries.<sup>7,9</sup> The overall cost of treatment is a major factor in deciding the modality of treatment in rural areas of developing countries & with almost same effectiveness external fixators are way cost effective.<sup>10</sup> We generally treat compound IIIB fractures with intramedullary nailing either primary or delayed, however, there is a subset of patients who cannot cope with financial implications because of repeat surgical interventions, so we continued the external fixator as a primary & definitive management. This retrospective analysis was done with an aim to evaluate the

functional outcome & complications of external fixation as a primary and definitive line of management for Gustilo IIIB open fractures tibia.

### Materials and Methods

This retrospective analysis was done in a tertiary care institute of northern India, which serves as a referral centre for peripheral/rural health centres from almost ten districts. Between Jan 2010 & May 2014 a total of 153 patient of compound IIIB fractures were treated at this institution. We excluded the patients that were treated by primary IMIL, delayed IMIL, Gustilo Anderson I, II, IIIA, IIIC fractures, incomplete data & poly-trauma patients with other severe injuries that can influence the rehabilitation & outcome. A total of 37 patients constituted the study group that were treated by simple tubular external fixation as a primary & definitive mode of treatment & having at least one year of follow up. The data regarding status of union, infection, pin loosening, malunion time of weight bearing and any other associated complication was noted. All the data was recorded from patient history sheets, admission & discharge summaries, follow up OPD consultation slips, however, the quality of images was not good enough as we didn't had a computerised data record system in our hospital. We allowed the patients to bear partial weight at around 10 weeks followed by conversion to PTB cast and weight bearing as

dictated by clinical & radiographic progression of healing. The statistical analysis was done using Microsoft Excel.

### Results

There were 31 males (83.7%) & 6 females (16.2%) with Gustilo IIIB fractures, treated by simple tubular external fixation as a primary and definitive mode of treatment during the study period with a mean age of  $37.43 \pm 8.92$  years and a standard error of 0.55. Right tibia was fractured more frequently ( $n=24$ ) compared to left ( $n=13$ ) yielding a ratio of 1.84:1. The commonest mode of trauma was road traffic accidents followed by fall from height & direct trauma to the limb. All the patients under study, reported within 24 hours of injury and were operated in emergency within 24 hours with debridement of wound and primary external fixation. Repeat debridement if required was done within 48-72 hours, early soft tissue coverage (within 7 days) was preferred whenever required. The average time to union was  $22.13 \pm 2.68$  weeks in our study with a range of 16-28 weeks. Superficial pin track infection occurred in 11 cases & deep infection leading to loosening of Schanz screw, requiring reapplication of pin, was seen in two patients. All the superficial pin infections were managed by daily dressings, wound lavage and a short course of antibiotics on a day care basis. We applied PTB cast in all our patients and allowed full weight bearing after seeing clinical & radiological signs of healing, to further consolidate the fracture healing. There were two cases of delayed union (5.40%) in our series, three cases of non-union (8.10%) that required additional procedures like bone grafting, intramedullary nailing & plating to achieve union.

### Discussion

The management of compound Gustilo type IIIB fractures is not well defined with much controversy among the available choices. There are many factors which help decide among available options including condition of wound, available resources, surgical expertise, associated injuries & comorbid conditions, however, there are no well-defined guidelines. Many researchers have supported primary external fixation of open tibial fractures followed by definitive internal fixation as and when the soft tissue condition permits.<sup>2,10-13</sup> In a meta-analysis of randomized controlled studies comparing primary external fixator with intramedullary interlocked nailing (unreamed) no statistically significant difference was found between the two procedures.<sup>14</sup> The authors further carried out an indirect comparison between reamed & un-reamed nailing & concluded that reamed nailing reduces the rate of re-operation but not that of infection and non-union.<sup>15</sup> Giannoudis et al reported a 24% incidence of delayed union in 536 open fractures treated by external fixator of which 82% were Gustilo type III fractures.<sup>16</sup> In another study on external fixator as definitive mode of treatment in 212 patients, Michail Beltrios et al reported a union rate of 87.27%, they had eighteen cases of non-union, 21 delayed unions and four cases of mal-union, pin-track infection was seen in 26.36% of patients and chronic osteomyelitis in three

cases.<sup>17</sup> We generally use this method only, but a subset of patients in our institute could not afford the financial burden of repeated surgeries and involved implant costs which constituted this study. As external fixator was available in our institute and was provided free of cost to the patient, we continued it as a definitive method (Fig 1 & 2). Many surgeons have alleged that there are conclusive advantages of primary intramedullary nailing provided the risk of infection could be lowered by cautious and radical debridement of wounds and proper use of antibiotics. The sequential technique of secondary nailing after external fixation may be associated with a high rate of complications.<sup>4,7</sup> Padhi et al had evaluated & analysed the factors affecting management of open tibial fractures in rural & tribal areas of developing countries, they observed an average time to union of 25.7 weeks in type III compound fractures, some sort of pin track infection in 22 cases, of which seven needed pin reapplication, however, they had only three cases of type III fractures in their study. In the rural areas of developing countries, cost is one of the most significant factors guiding the treatment strategy.<sup>10</sup> The patients don't have medical insurance in most of the situations and are unable to cope with the cost of medical care. The average time to union in our study was 22.13 weeks which was comparable with other published series, delayed union in two cases, non-union was seen in three cases which underwent freshening of bone ends, bone grafting and intramedullary nailing.<sup>18-21</sup> One patient of non-union underwent plate augmented nailing after freshening, decortication & iliac crest bone grafting (Fig. 3). In another study on efficacy of external fixators as a primary method of treatment, 79 compound tibial fractures were treated with unilateral uniplanar external fixators. Average time to union was 20 weeks, pin track infection was seen in 45.2% patients, ankle stiffness in 10.9% and leg shortening in 2.8%.<sup>18</sup> The incidence of superficial pin track infection in our series was 29.72% that was managed by standard procedures and deep seated infection leading to pin loosening and a need for reapplication was observed in two patients (5.40%).



**Fig. 1: (A) Clinical image showing open tibial comminuted fracture with exposed bone; (B): Radiographs of same patient in both AP & Lateral projection showing fracture geometry; (C): Post-operative radiograph showing fracture reduced in proper alignment with an external fixator (D) Clinical image showing closure of wound & fixator in place**





**Fig. 2 (A): Pre-operative radiograph of an open tibial fracture; (B): Post-operative radiograph of same patient with external fixator; (C): Final clinical image of leg after thorough debridement & closure of wound**



**Fig. 3: (A) Radiograph of patient with external fixator with no signs of healing; (B): Radiograph of same patient after removal of external fixator, curettage of pin tracks & application of cast till definitive treatment; (C): 6-week post-operative radiograph after open reduction, bone grafting and plate augmented nailing**

### Conclusion

This retrospective analysis revealed that external fixators can be safely used as the primary and definitive mode of treatment in Gustilo type IIIB open fractures of tibia, with satisfactory results comparable to other modalities, in a cost-effective manner, especially in the resource limited conditions of developing countries.

**Conflict of Interest:** None.

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