

## ORIGINAL ARTICLE

### MANAGEMENT OF INFECTED NON UNION TIBIAL FRACTURES WITH ILIZAROV EXTERNAL FIXATION

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**ABSTRACT: BACKGROUND & OBJECTIVES:** Infected non-union of tibia per se is a challenge to treat. Subcutaneous bone causes susceptibility to compartment syndrome, non-responsive infection, non-union, fibrosis, sinuses, deformities, shortening and various other sets of problems which are associated with it. Ilizarov External fixation provides correction of all the complications associated with non-union, bone gap, infection, shortening, and deformities. Objective of this study is to assess the efficacy and safety of Ilizarov fixator method of treatment in infected non-union tibia and to study various complications associated with Ilizarov external fixation.

**MATERIALS AND METHODS:** 23 patients admitted and treated in Government General Hospital under the Department of Orthopaedics during the period of May 2010 to December 2012 were included in the study. Results were evaluated according to ASAMI criteria.<sup>1</sup> **RESULTS:** 59% patients had excellent bony results, 27.3% had good bony results, 9.1% had fair bony results, 4.6% had poor bony results. 68.1% had excellent functional results, 9.1% had good functional results, 9.1% had fair functional results, 13.7% had poor functional results. **CONCLUSION:** Ilizarov external fixator system is the best device and best solution for infected non-union tibia management.

**KEYWORDS:** Infected non-union, Tibia fracture, Ilizarov external fixation.

**INTRODUCTION:** Infected non-union of tibia per se is a challenge to treat. Subcutaneous bone causes susceptibility to compartment syndrome, non-responsive infection, non-union, fibrosis, sinuses, deformities, shortening and various other sets of problems which are associated with it. There is flaring of the infection and various antibiotics not acting frustrate the patient as well as the surgeon. Patient getting depressed and the huge burden of cost of different modalities make life miserable. Ilizarov Technique is based on the principles of Tension-stress effect and distraction histiogenesis. When a living tissue is distracted in a controlled way, it produces new tissue of the same kind called as regenerate. Ilizarov technique uses external fixation principles providing multi planar stability. Ilizarov External fixation provides correction of all the complications associated with non-union, bone gap, infection, shortening, and deformities. Corticotomy, stable fixation, and bone transport employed reduces or eliminates infection at the same time achieving bone union and correction of limb length discrepancy. Pin tract infection, joint stiffness especially ankle, osteomyelitis, neurovascular injury are a few complications associated with Ilizarov technique. With experience, these complications can be reduced to minimum. Good patient compliance is a must as duration of fixator is for a long period and a multiple procedure is undertaken. Main aim of treatment of infected nonunion tibia fractures is to

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get excellent bony and functional outcomes. This study was to assess the efficacy and safety of Ilizarov fixator method of treatment in infected non-union tibia and to study various complications associated with Ilizarov external fixation.

**MATERIALS AND METHODS:** 23 patients admitted and treated in Government General Hospital under the Department of Orthopaedics were included in the study. Inclusion criteria included infected on union tibia fractures in age group of 15 to 75 years between May 2010 to December 2012. Exclusion criteria included patients under the age group of 15 years and above 75 years. The patient admitted with fracture of tibial shaft with infected non-union were thoroughly examined and questioned. Patients were shown the fixator and informed in detail as to what procedures we are going to perform on him and period of treatment was informed to all patients. Pre-operative X-rays, investigations, etc., were done and documented. Pre-operative planning according to the site of infected non-union and pre-planning the site of corticotomy if needed were done as per standard procedure. Patients were operated under regional anaesthesia. Postoperatively the pin tracts are sealed with Povidone -Iodine soaked gauze pieces. Patient is encouraged to ambulate himself from the first post-operative day with crutch walking and partial weight bearing. Sutures are removed on the 10<sup>th</sup> post-operative day and corticotomy site is distracted at 1 mm/ day, 1/4<sup>th</sup> mm 4 times a day. Patient is taught pin care & method of distraction. Post-operative x-rays are taken at periodic intervals, the first x-ray at immediate and 2 weeks post-operatively. Thereafter the patient is followed up on out-patient or in-patient basis at regular intervals depending on bone gap, bone transport, infection, severity, etc. At each clinical follow up, the patient is assessed clinically and radiologically. If required, patient may be admitted while being followed up for further management. Physiotherapy is mandatory during the entire treatment protocol. Patient is encouraged full weight bearing during the entire treatment period. The patient is to be told the importance of regular follow-up, rigorous physiotherapy, etc. end results were evaluated using ASAMI criteria.

**RESULTS:** Following results were obtained and following observations were made. In this study of 23 Patients with 23 limb segments have been studied. Minimum age was 16 years and maximum age was 75 years in this study. Mean age was 38.87 years. Maximum patients were between 21- 30 years (7 patients) followed by 31- 40 years (6 patients). 21 patients were male and 2 were female in our study. We had 13 of 23 patients (56 %) with Type III Compound injury, 2 cases (9%) had type 1 compound injuries, 5 cases (22%) had type 2 compound injuries. With the severity of the trauma, the infection chances rise significantly. All cases in the study group sustained high velocity injury due to Road traffic accidents. 3 patients had prior plating, 9 patients had nailing and 11 patients had external fixation done. 3 patients had upper 1/3<sup>rd</sup> non union, 6 patients had middle 1/3<sup>rd</sup> and 14 had lower 1/3<sup>rd</sup> non-union. Average duration of nonunion period was 12 months (min- 2 months, max- 92 months). Mono focal osteosynthesis was done in 65% of patients and bi focal osteosynthesis in 35% of patients. Average length of the regenerate was 2.56 cm (min – 0.1cm, max – 6 cm). Bone marrow infiltration was done in 67 % of our cases. No bone grafting was done. The average duration of Ilizarov External Fixator period in our study was 8.6 months (min – 1.5 months, max – 14 months). Tibia had shortening

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of 1 – 8 cm with an average of 2.75 cm. The above shortening though present or absent changes depending upon the method of treatment. For example, after excising the infected non-union, there is a gap of at least a few centimeters which is reduced by acute docking of this intra-operative gap non-union, thus increasing the shortening of the limb. All cases had ankle joint stiffness and two cases had permanent ankle stiffness and sub talar joint stiffness. Poor regenerate was seen in 2 cases delayed regenerate was seen in 3 cases, pin tract infection was seen in all cases. Change of frame/wire due to infection was done in 4 cases, wire breakage seen in 2 cases, 1 patient had re-fracture. Shortening >2.5cm seen in 8 cases, >7° angulation seen in 6 cases, 6 patients had equines deformity. In our study, the length gained in Tibia is 2.56 cm (min – 0.1cm, max – 6 cm). Average lengthening index in this study was 1.98months/cm compared to Nicholas Rajacich et al.<sup>2</sup> Final results were evaluated according to A.S.A.M.I criteria.<sup>1</sup> 1 patient did not turn up for follow up. Results of 22 patients are as follows. 59% (13) patients had excellent bony results, 27.3% (6) had good bony results, 9.1% (2) had fair bony results, 4.6% (1) had poor bony results. 68.1% (15) had excellent functional results, 9.1% (2) had good functional results, 9.1% (2) had fair functional results, 13.7% (3) had poor functional results.

**DISCUSSION:** Non-union is defined as the state of fracture which even after 6 months duration does not show any evidence of union (Gustilo et al, 1983). As Watson Jones put it, 'Infection is not a cause for non-union'. If non-union is allowed to occur, it is not due to infection but due to inadequate immobilization permitted by reason of infection. Conventional and other modalities of treatment do not address the associated problems of non-union such as limb shortening deformities and joint stiffness which may be functionally disabling to the patient. Union may not be always being achieved for more than one reason. Ilizarov technique comes in as a useful procedure in such situations. It provides a multi factorial comprehensive approach to the problem of infected non-union and combines the principles of conventional and active method of treatment of infected non-unions.

Upon comparing with other studies following were observed.

RESULTS	EXCELLENT	GOOD	FAIR	POOR
Our Study	59%	27.3%	9.1%	4.6%
Dror Paley et al <sup>3</sup>	60.87%	26.09%	8.7%	4.35%
Madhusudhan et al <sup>4</sup>	22%	36.34%	22%	18.18%
Dendrinios et al <sup>5</sup>	50%	29%	3.6%	17.4%
Lalit Maini et al <sup>6</sup>	70%	10%	0%	20%

**TABLE 1: BONY RESULTS COMPARISON**

RESULTS	EXCELLENT	GOOD	FAIR	POOR
Our Study	68.2%	9.1%	9.1%	13.7%
Dror Paley et al <sup>3</sup>	64%	28%	4%	4%
Madhusudhan et al <sup>4</sup>	5.56%	22.22%	33.33%	38.89%
Dendrinios et al <sup>5</sup>	25%	39.2%	14.13%	2.15%
Lalit Maini et al <sup>6</sup>	26.7%	40%	10%	28.3%

**TABLE 2: FUNCTIONAL RESULTS COMPARISON**

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In this study male patients to female patients ratio is 11.5:1. Average age of the patient in this study group was 38.87 years. Dendrinos et al<sup>5</sup> study had age group of eighteen to seventy-four years old. Dr. Dror Paley<sup>3</sup> et al treated twenty-five patients aged 19-62 years.

The average duration of Ilizarov External Fixator period in our study was 8.6 months (min – 1.5 months, max – 14 months). In Lalit Maini et al<sup>6</sup> study median time in the Ilizarov frame was 150 days. Median follow up time after frame removal was 23.5 months. In Dendrinos et al<sup>5</sup> study the mean duration of treatment was ten months. The mean duration of follow-up was thirty-nine months. In Madhusudhan et al<sup>4</sup> the average duration of fixation of 9.3 months [6.5– 13 months], average follow up of 13 months following fracture union.

In this study average length of the regenerate was 2.56 cm (min – 0.1cm, max – 6 cm). In Dendrinos et al<sup>5</sup> study the size of the bone defect that was bridged averaged six cm (range, two to thirteen cm).

In this study tibia had shortening of 1 – 8 cm with an average of 2.75 cm. In Dendrinos et al<sup>5</sup> study the inequality of the lengths of the legs were corrected successfully to less than 2.5 cm.

Present study showed 59% (13) patients had excellent bony results, 27.3% (6) had good bony results, 9.1% (2) had fair bony results, 4.6% (1) had poor bony results. 68.1% (15) had excellent functional results, 9.1% (2) had good functional results, 9.1% (2) had fair functional results, 13.7% (3) had poor functional results. In Lalit Maini et al<sup>6</sup> study the bone result was excellent in 21 patients (70%), good in three (10%), fair in none (0%) and poor in six (20%). The functional results were excellent in eight patients (26.7%), good in 12 (40.0%), fair in three (10%) and poor in seven (23.3%). In Dendrinos et al<sup>5</sup> clinical study eight had a good bone result; one, a fair result; and five, a poor result. The functional result was excellent in seven patients, good in eleven, fair in four, and poor in five. Dror Paley et al<sup>3</sup> study had 60.87% excellent bony results, 26.09% good bony results, 8.7% fair bony results, 4.35% poor bony results, 64% excellent functional results, 28% good functional results, 4% fair and poor functional results.

In comparison to Dror Paley's study<sup>3</sup>, present study success rate in all 4 categories has approached Dror Paley's<sup>3</sup> Bony results. In case of functional outcome present success rate in excellent category has approached Dror Paley's result.

**CONCLUSION:** By the present study encouraging results have been achieved in treating infected non-union tibia fractures using Ilizarov external fixation. Hence Ilizarov external fixation appears to be the best fixation device for the management of infected non-union tibia fractures.

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