

MANAGEMENT OF DISTAL METAPHYSEAL FRACTURES OF TIBIA USING HYBRID EXTERNAL FIXATORM. Nageshwara Rao¹, A. M. Ilias Basha², K. B. Vijaya Mohan Reddy³, G. Praneeth Kumar Reddy⁴**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: AIMS AND OBJECTIVES: Distal tibial fractures represent a significant challenge to orthopaedicians. The low energy fractures get dramatic results with open reduction and internal fixation. But high energy fractures have a high amount of complications due to soft tissue coverage, skin necrosis, infections and also the usually comminuted nature of the fractures. Conservative treatment by cast application leads to prolonged immobilization, ankle and knee stiffness affecting quality of life of the patient. The Hybrid External Fixator combines the advantages of the monolateral pin fixators and the circular Ilizarov wire fixators. The tensioned wires provide improved fixation in the small distal cancellous fragment, as they have rapid and straight forward application, reduced surgical time and is minimally invasive. It is adjustable, hence reduction can be easily attained after frame assembly. With rigid fixation it also allows immediate mobilization of the knee and ankle joints and early weight bearing. Aim of this present study is to study and establish the results and functional outcome in surgical treatment of distal metaphyseal fractures of Tibia using a Hybrid External Fixator. **MATERIALS AND METHODS:** 25 patients with distal tibial metaphyseal fractures were studied from June 2010 to July 2012 in department of Orthopaedics, Government General Hospital, Kurnool and followed up for a period of 6-10 months. Ovadia and Beals¹ scoring system of objective and subjective evaluation was used in this study to assess the results. **RESULTS:** All the fractures consolidated with average of 13 weeks. All the studied fractures resulted in good union. Three of the 5 compound fractures and 2 of the 20 simple fractures developed pin tract infections. Twelve patients had ankle stiffness from 20-90% of total ankle movement. Two cases had a malunion with an anterior angulation of 5 degrees but had a good ankle function. At 6 months, results were based on objective and subjective parameters by Ovadia and Beals.¹ 12 (48%) patients had excellent outcome 7 (28%) had good, 5 (20%) had fair and 1 (4%) patient had a poor outcome. Subjective parameters showed 21 (74%) good to excellent results and 4 (16%) patients with fair results. **CONCLUSION:** Hybrid external fixator is simple, rapid and straightforward application, reduces surgical time, minimally invasive and adjustable. It has negligible complications and resulted in excellent results for this type of fractures.

KEYWORDS: Tibia, Metaphyseal fractures, Hybrid external fixator.

INTRODUCTION: The difficulty in treating the fractures of distal tibial end is exemplified by orthopaedists, who in the first half of twentieth century, believed these injuries were so severe and fraught with so many complications, that the fracture was deemed not amenable for surgical reconstruction.² Distal tibial fractures represent a significant challenge to most of the surgeons

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even today. They are only 1-10% of all lower extremity fractures.³ high energy fractures are documented to show a high amount of complications due to soft tissue coverage, skin necrosis, infections and also the usually comminuted nature of the fractures.⁴ Conservative treatment by cast application lead to prolonged immobilization, leading to ankle and knee stiffness affecting quality of life of the patient.⁵ Introduction of the external fixator was a revolution in the evolution of management of fractures. The Hybrid External Fixator combines the advantages of the monolateral pin fixators and the circular Ilizarov wire fixators. The tensioned wires provide improved fixation in the small distal cancellous fragment, whereas the pin fixators give adequate stability to the proximal fragment. It is simple, has a rapid and straight forward application, reduced surgical time and is minimally invasive. It is adjustable, hence fracture reduction can be easily attained after frame assembly.⁶ Along with rigid fixation, it allows immediate mobilization of the knee and ankle joints and early weight bearing. "Early motion has been touted as the functional savior of major intra articular injuries".⁷ Various modalities of treatment include closed treatment without reduction, open reduction and internal fixation, external fixation on the same side of the joint, ankle spanning external fixators. All these were met with complications like malunion, nonunion, delayed union, infection and wound breakage, decreased motion, ankle arthrosis. Hybrid external fixation avoids above said complications and assists in early ambulation.

MATERIALS AND MEETHODS: Between June 2010 and July 2012, twenty-Five consecutive adult patients with fresh fractures of the distal tibial metaphysis were treated with the Hybrid External Fixator at Government General Hospital, Kurnool. Inclusion criteria was age above 21 years, fresh closed and open fractures of distal tibial metaphysis, intraarticular and extra articular fractures of the distal tibia. Exclusion criteria was age below 21 years, massively comminuted intraarticular fractures, type C3 (AO/OTA) of distal tibia. Thorough physical examination was done, radiographs of involved extremity taken, limb immobilized with plaster slab until definitive fixation. Regular blood investigations were done, required additional investigations were done on individual patient basis. All patients were treated with hybrid external fixator under spinal anaesthesia. The patients were followed up at intervals of three weeks for up to 6-10 months to assess the radiological union and to check the stability of the construct. Ovidia and Beals¹ scoring system of objective and subjective evaluation was used in this study to assess the results.

RESULTS: The present study consists of 25 cases of fracture of the distal metaphyseal end of tibia. The age of the patients ranged from 24-62 years and most common in the 4th and 6th decade and an average age of 41.16 years. Out of 25 patients, 21 (84%) patients were males and 4 (16%) patients were females showing male preponderance because of traveling and working in fields and factories. There were 16 (64%) patients with right distal tibia fractures 9(36%) patients with left distal tibial fractures. In our study, 18 (72%) of patients sustained injury following road traffic accident and 7 (28%) patient sustained injury following fall. Out of the 25 cases, 20 (80%) cases were closed fractures and 5(20%) cases were open fractures. the 5 cases of open fractures classified based on Gustilo Anderson classification of open fractures, 1 (20%) was type I compound 3 (60%) were of type II compound and 1(20%) was of type III B

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compound. The fracture pattern was classified based on AO/OTA classification for fractures of distal tibia of the 25 cases studied, 5 (20%) cases were A1, 6(24%) were A2, 10(40%) were A3 and 4 (16%) cases were C1 type of fracture. All but one of 25 cases studied had an associated fracture of the lower third of fibula. The one case with intact fibula had to be osteotomized to give adequate compression at the tibial fracture site. 10 (64%) cases took 31-50 minutes, 4 (16%) took 51-60 minutes, 3(12%) took 61-70 minutes 2(8%) took 71-80 minutes. The surgical time averaged 52 minutes. In three of the patients, we had stabilized the coronal fracture of the distal tibia using anteroposterior compression screws percutaneously. In two of the patients the fibular fracture was fixed using a 6 holed 1/3rd semi tubular plate and screws. All the fractures united with an average of 13.16 weeks (12-15weeks). There was no delayed union or non-union. Fractures of 7 (28%) patients united in 12 weeks, 10(40%) patients united in 13 weeks, 5 (20%) fractures united in 14 weeks and in 3 (12%) patients the fractures united in 15 weeks. The fixators were removed at an average of 13 weeks. In five patients, the fixators were removed earlier (10-12 weeks) as they had pin tract infections. The results were based on the objective and subjective parameters as described by Ovadia DN and Beals RK. ¹ At the end of 6 months of the 25 patients treated, 12 (48%) patients had excellent outcome, 7 (28%) had good results, 5 (20%) had fair outcome and 1 (4%) patient had a poor result.

Results	No. of cases	Percentage
Excellent	12	48
Good	7	28
Fair	5	20
Poor	1	1

Table 1: Showing objective results

Results	No. of cases	Percentage
Excellent	12	48
Good	9	36
Fair	4	16
Poor	0	0

Table 2: Showing subjective results

Five of the patients developed superficial pin tract infections. We had 12 patients with ankle stiffness. Two patients developed an anterior angulation of 5⁰.

DISCUSSION: Fractures of distal tibia are among the most difficult fractures to treat effectively. The status of the soft tissues, the degree of comminution and articular damage sustained at the time of injury affect the long term clinical results. The goal of operative treatment is to obtain anatomic realignment of the joint surface while providing enough stability to allow early motion. The present study was under taken to determine the efficacy of the Hybrid External Fixator in treatment of the fractures of the distal tibial metaphysis. This study revealed the average age of

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patients with such injuries to be 41 years (24-62). It is comparable with a study on similar fractures conducted by RF Gaudinez, Arati R. Mallik and Monroe Szporn⁸ whose average age was 35, and also study by R. Barbieri, Richard Schenk, Kenneth Koval et al⁹ where average age was 39 years. In this study, the male preponderance was high 84% compared to the study by Barbieri et al⁹, which was 59% possibly due to the fact of male dominance over the female in traveling, occupational injuries etc., in India. However, the study by Ovadia and Beals¹ were comparable in the fact that they had 67% male patients. Gaudinez⁸ et al observed 93% high energy fractures in his study. Ovadia and Beals¹ could attribute only 46% of such injuries to be of high energy. However, this present study correlates with the study conducted by Barbieri et al⁹ similar fractures in which they noted 75% high energy trauma. Our study showed 75% high energy trauma. This study had 20% open injuries. This was comparable on the studies conducted by Gaudinez et al⁸ who has 21% open fractures, Ovadia and Beals¹ who reported 20% open injuries. Barbieri et al⁹ however had 30% of open injuries. The average surgical time was 52 minutes (40-80 minutes). It is comparable with the average of 62 minutes taken by Gaudinez et al⁸ in their study. The average time for fracture union in various studies conducted using various methods was 13-16 weeks. This study had an average fracture union of 13 weeks which were comparable with studies conducted using the hybrid external fixator. Barbieri et al⁹ had an average fracture union of 14 weeks and Gaudinez et al⁸ had an average of 13 weeks. In this study, we removed the fixator at an average of 13 weeks. It is however lower than the 14.5 weeks in a similar study by Gaudinez et al,⁸ probably due to the fact that fixators with pin tract infections were removed earlier (10-12 weeks) and PTB cast was applied for 2-3 weeks. Barring the 5 patients with pin tract infection, the average fixator removal time was 14 weeks, which is comparable to the similar study. Tornetta et al,¹⁰ accomplished 69% good results in the high energy injuries and major complications were avoided. There was one deep infection, one superficial infection, one malunion and three pin tract infections. Barbieri et al⁹ achieved 67% good results using the hybrid external fixator. There were three cases of osteomyelitis, one skin sloughing and five pin tract infections. Three patients had a loss of reduction and required frame revision. Gaudinez et al⁸ based their study on the scale by Ovadia and Beals¹ with 64% patients having good to excellent subjective results, and 71% patients had Good to excellent objective results.

Complications included superficial pin tract infections in 3 patients, all of which resolved with local pin care and a short course of orally administered antibiotics. There were no deep infections. In this study, we had 12 (48%) patients with excellent, (7 (28%) patient with good, 5 (20%) patients with fair and 1 (4%) patient with a poor outcome. However, we had excluded the C3 (AO/OTA) fractures, which formed a significant part of the other similar studies. The 76% good to excellent result is better than or equal to most of the series. There were five superficial pin tract infections, which resolved on meticulous pin care and oral antibiotics. Twelve of our patients had ankle stiffness of varying degrees.

This was probably due to the incompletion of the patients to the physiotherapy regimen advised. We had 2 malunions with anterior angulation of 5°. Barring the 12 patients with ankle stiffness, the 28% rate of complications is comparable with the other studies.

Clinically (subjective) results showed 84% good to excellent results and 16% fair results.

Patients who had an excellent or good result on the objective evaluation invariably had an

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excellent or good final subjective evaluation result. Some patients who only had a fair or poor result in the objective evaluation also had a satisfactory final subjective result. This indicated that minimum limitation of motion, mal alignment and shortening did not preclude a good clinical result.

CONCLUSION: This technique has resulted in the effective stabilization of these fractures. It does provide adequate stability and allows early motion. The closed reduction not only helps in achieving reduction in difficult situations, but also in rapid union, because it facilitates preservation of the blood supply to the fragment. This method limits further damage to the already compromised soft tissue. Its greatest advantage is in open fractures where wounds can be left open. It is also effective in extra articular fractures occurring within 5cm of the joint because, Intramedullary nails often do not provide enough stability and plates would require extensive soft tissue dissection.

It is a simple, has a rapid and straight forward application and has a reduced surgical time. Tensioned wires provided improved fixation in small and osteoporotic fragments.

When encountered with the unreconstructable distal tibial fracture, Hybrid External Fixator satisfies the goals of plantigrade foot and soft tissue healing, without obviating any other means of further treatment.

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