Section: Orthopaedics

Original Research Article

HYBRID EXTERNAL FIXATOR IN DISTAL TIBIAL FRACTURES: HOSPITAL BASED STUDY ON FUNCTIONAL OUTCOME IN URBAN TAMILNADU

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Abstract

Background: Distal tibial fractures constitute only 1-10% of fracture in the lower extremity, yet they continue to be among the most difficult to manage and treat. The Hybrid External Fixator, one of the latest innovations is more preferred as it provides the merits of both the monolateral pin fixators and the circular Ilizarov wire fixators. The present study was undertaken to assess the functional outcome of distal tibia fractures while using hybrid external fixator. **Materials and Methods:** Patients with distal tibial fractures who attended the Orthopaedic department and Emergency department of Government Villupuram Medical College between January to December 2022.A total of 20 patients were taken up for the study. **Result:** Majority of the study participants were male aged between 35-50 years of age. 60% of the study participants had the fracture in the right side, the most common type of factors were closed fractures. Fracture union was predominantly at 13 weeks, while the fixator was removed at 14 weeks for 50% of the study population. The functional evaluation was excellent in 12 cases 6 had good results and 2 had fair results. **Conclusion:** Hybrid external fixation of the distal tibia fracture allows satisfactory reduction, maintaining limb length, with minimal soft tissue handling and allows early ankle mobility. In compound fractures allows early soft tissue cover and decreased incidence of infection and bony union.

INTRODUCTION

Distal tibial fractures constitute only 1-10% of fracture in the lower extremity, yet they continue to be among the most difficult to manage and treat.[1] Distal Tibial fractures encompass a spectrum of skeletal injury ranging from fractures caused by low-energy rotational forces to those precipitated by high-energy axial compression forces. The management of these fractures was a tedious endeavour for orthopaedists all around the globe.[2] The fractures due to low energy rotational forces often require open reduction and internal fixation, whereas the fractures due to high energy comminuted fractures result in various complications like skin necrosis, infections and also the usually.[3]

The earlier modalities of treatment for distal tibial fractures like cast application had an adverse effect on the quality of life of the patient. The main reasons were stiffness of the ankles as knees as a consequence of prolonged immobilisation.[4] The introduction of external fixators in the management of fractures is among the path breaking innovations in the management of fractures.[4]

The Hybrid External Fixator, one of the latest innovations is more preferred as it provides the merits of both the monolateral pin fixators and the circular Ilizarov wire fixators. Studies have shown that the hybrid external fixators provide both better fixation as well as stability. The other merits of hybrid fixators include decreased time in surgery, minimally invasive and earlier weight bearing.[5] The present study was undertaken to assess the functional outcome of distal tibia fractures while using hybrid external fixator.

MATERIALS AND METHODS

The present study included patients with distal tibial fractures who attended the Orthopaedic department and Emergency department of Government Villupuram Medical College between January to December 2022.A total of 20 patients were taken up for the study, all the patients who consented to take part in the study were included.

Inclusion Criteria

1. Age above 21 years
2. Fresh closed and open fractures of distal tibia

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3. Intraarticular and extra articular fractures of the distal tibia.

Exclusion Criteria

1. Age below 21 years.
2. Associated shaft of tibia fractures, talus fractures, vascular injuries.

Classification

In the present study fractures were classified based on the AO/OTA classification.[6] Type A fractures are extraarticular distal tibial fractures, which are subdivided into groups A1, A2, and A3, based on the amount of metaphyseal comminution. Type B fractures are partial articular fractures in which a portion of the articular surface remains in continuity with the shaft; these are subdivided into groups B1, B2, and B3, based on the amount of articular impaction and comminution. Type C fractures are complete metaphyseal fractures with articular involvement; these are subdivided into groups C1, C2, and C3, based on the extent of metaphyseal and articular comminution

Imaging

All patients were taken initially antero posterior and lateral view x rays and fractures classified according to AO/OTA classification. Compound fractures classified according to Gustilo Anderson classification.[7] For intra-articular fractures CT scan of ankle taken to evaluate fracture patterns.

Management

All closed fractures were initially treated with above knee slab. The fractures were the managed electively with hybrid external fixators. Compound fractures were taken under emergency procedure –wound debridement and hybrid external fixator .soft tissue cover if needed were done subsequently.

Follow up

Patients with closed fractures were discharged after 1 week, while patients with compound fractures were treated as inpatient for a period of 15 days. The study participants were then followed up weekly for the first month, biweekly for next month and monthly thereafter. Clinical and radiological assessment were done during every visit. Minor pin tract infections were treated with appropriate antibiotics.

When there was periosteal bridging callus at the fracture site in at least three cortices in the antero-posterior and lateral views, the fracture was deemed to be unified. Also taken into account were trabeculations that crossed the fracture site. Based on the radiographic consolidation and union of the fractures, both partial and complete weight bearing were permitted. After full fracture union, simple fixators were removed. Prior to applying a patellar tendon-bearing cast and removing fixators with pin tract infections, the fracture had not yet radiologically fused. Ovadia and Beals rating scheme was employed in this study to evaluate the outcomes.[8]

RESULTS

Our results showed that majority of the study participants were aged between 35-50 years of age. While those above 50 years of age constituted 35% of the study population, 15% were aged less than 35years. Majority of the study participants were male (85%), 15% of the study population were female.

In the present study, 60% of the study participants had the fracture in the right side, while 40% of the participants has fractures in the left side. The most common type of factors were closed fractures followed by grade 1 Grade 2 and grade 3A (20% each).Grade 3B type of fractures were observed in 10% of the study population. Among majority of the study population fractures classified as A1 category constituted 40% followed by A2 and C3 which constituted 15%. Patients with A3, B2 and C1 constituted 10% each, while 5% of the study population had B1 and B3 type of fractures.

In the present study fracture union duration was at 13 weeks among 50% of the study population whereas facture union was 12 weeks among 25% of the study population. The time taken for the union of fractures at 14 and 15 weeks was observed among 15% and 10% of the study population respectively. In the present study, among 50% of the study population the fixator was removed at 14 weeks. The fixator was removed at 13 weeks for 30% of the study population while the fixator was removed at 12 weeks for 10% of the study population. The fixator was removed at the 13th and 14th week for 5% each of the study population.

In the present study the functional outcome of the study participants was measured objectively and subjectively. The objective outcome showed excellent results were observed in 60% of the study population whereas good objective outcome was observed among 30% of the population. Fair and poor results were observed in 5% of the study population each. The subjective outcome showed excellent functional outcome in among 60% of the study population, good results were observed in 30% of the population whereas fair results were observed in 10% of the study population. Pin tract infection was reported in 5 cases treated with appropriate antibiotics. Pin loosening was observed in 2 cases and were replaced with fresh pins. No incidence of Malunion and non-union was observed in the present study.

Table 1: Characteristics of the study population

Variable	Frequency (n=20)	Percentage
Age (in years)		
21-35	3	15
35-50	10	50
> 50	7	35

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Gender		
Male	17	85
Female	3	15
Side		
Right side	12	60
Left side	8	40
Type Of Fracture		
Closed fractures	6	30
Grade 1	4	20
Grade 2	4	20
Grade 3A	4	20
Grade 3B	2	10
Fracture Classification		
A1	5	25
A2	3	15
A3	2	10
B1	1	5
B2	2	10
B3	1	5
C1	2	10
C2	1	5
C3	3	15

Table 2 Duration for fracture union and fixator removal

Variable	Frequency (n=20)	Percentage
Fracture union duration (in weeks)		
12	5	25
13	10	50
14	3	15
15	2	10
Fixator removal duration (in weeks)		
10	1	5
11	1	5
12	2	10
13	6	30
14	10	50

Table 3 Functional outcome of the study participants

Variable	Frequency (n=20)	Percentage
Objective results		
Excellent	12	60
Good	6	30
Fair	2	5
Poor	1	5
Subjective results		
Excellent	12	60
Good	6	30
Fair	2	10

Table 4: Complications among the study participants

Complications	Frequency (n=20)	Percentage
Pin tract infection	5	25
Pin loosening	2	10
Malunion	0	0
Non union	0	0

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DISCUSSION

The goals of treatment of distal tibial fractures are anatomical reduction, internal fixation, if needed primary bone grafting, fixation of fibula and early mobilisation. Open operative procedure involves damage of already jeopardised soft tissues. Minor injuries to these soft tissues result in devastating soft tissue complications such as skin necrosis, flap necrosis and persistent infection. To prevent these kind of serious complication minimally invasive procedures are advocated to attain articular alignment and limb length restoration. The present study was aimed to establish the effect of Hybrid External Fixator in the management of distal tibial fractures.

Our results showed that majority of the distal tibial fracture presented in the late 3rd decade, 4th and 5th decades of the study participants. Studies conducted by Rathod et al,[9] Guadinex et al[10] and Barbieri et al[11] have also reported similar findings wherein the incidence of distal tibial fractures are more prominent in the 35-55 age group. Distal tibial have been increasingly observed among males (85%) as compared to the females. These findings are mildly higher than the studies reported by studies in the western world.[10-11] Studies conducted in Indian subcontinent have reported the incidence as 84%.They have attributed these increased numbers to the socio-cultural environment which favours male dominance in traveling and occupational injures etc.[9]

In our study we observed that majority of the fractures were closed fractures. Our findings were similar to various other studies globally. They had reported that the incidence of closed fractures to be between 65-85%among the distal tibial fractures.[9-11]

In the present study we observed the average time for union of the fractures ranged between 12 to 16 weeks.

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Our results were comparable to Rathod et al,[9] and Gaudinez et al[10] who have also reported the duration of fracture union to be at 13 weeks.

Fixator removal in the current study was done predominantly after 13 weeks, with majority being removed after 14 weeks. Rathod et al had attributed early removal due to higher incidence of pin tract infection, and they have also established that after exclusion of eth said cases, the duration of fracture union was 14 weeks.[9] Our results are however in track with the findings of Gaudinez et al.[10]

The functional outcome of the patients post external hybrid fixation showed that the results were acceptable (excellent and good) in more than 90% of the study participants. Bourne et al had reported acceptable outcomes among 90% of the patients (10%) had a poor clinical result. They also reported minimal pin tract infections (20%), which is also comparable to our findings. Rathod et al in the study have reported an acceptability of almost 80%.[9] Bonar et al had a 69% acceptability, the lower acceptability has been attributed to the increased incidence of in tract infections.[13] Various studies have reported acceptability to be around 61-70%, in all these studies the complications especially the increased incidence of pin tract infections to be the major causative for the poor functional outcomes.[10, 11, 14]

CONCLUSION

Hybrid external fixation of the distal tibia fracture allows satisfactory reduction, maintaining limb length, with minimal soft tissue handling and allows early ankle mobility. In compound fractures allows early soft tissue cover and decreased incidence of infection and bony union. A study with a larger sample, preferably a multi-centric study will further contribute to understanding the effectiveness of hybrid external fixators in the management of complex fractures.

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