Interlocked Intramedullary Nailing in the Managenment of Closed Diaphyseal Fractures of Tibia- A Prospective Analysis

Vijay Baba N[1], Balaji Arumugam[2]

ABSTRACT

Introduction: Fractures of the tibial shaft are important for the reason that they are common and controversial. Our aim was to treat these fractures by closed inter locking intramedullary nailing, early mobilization and to assess the outcome of interlocking nailing in the treatment of these fractures.

Material and Methods: Twenty patients who had 20 closed fractures of the tibial shaft were treated with interlocking intramedullary nailing with reaming during the period from June 2009 to May 2011 at Meenakshi Medical college Hospital and RI. All the patients were examined clinically and radiographically, including a detail history of pre morbid status and occupation, at the time of admission. Patients fulfilling the inclusion criteria were only included in this study. All the patients were mobilized post operatively as early as possible depending upon the fracture stability, general condition, associated injuries and tolerance of the patient.

Results: All of the 20 patients with fracture were followed for a period ranging from 4 to 28 months. The knee range of movements is full in 13(65%) patients, less than 25° loss in 5(25%) patients and more than 25° loss in 2 (10%) patients. The ankle range of movements is full in 13(65%) patients, less than 25° loss in 4(20%) patients and more than 25° loss in 1(5%) patients. The post-operative results were excellent in 65% of patients, good in 25% and poor in 10% of patients and it was statistically significant ($P > 0.05$).

Conclusion: Closed interlocking intramedullary nailing is a feasible option in majority of the fractures of shaft of tibia.

Keywords: Closed tibial fractures, Intramedullary nailing, Ankle ROM, Knee ROM

INTRODUCTION

As industrialization and urbanization are progressing year to year with rapid increase in traffic, incidence of high energy trauma are increasing with the same speed. Fractures of the tibial shaft are important for the reason that they are common and controversial. The exposed anatomical location of the tibia makes it vulnerable to the direct blow and high energy trauma as a result of motor vehicle accidents thus resulting in comminuted fractures, which are frequently open with significant loss of skin and soft tissues. In contrast to the rest of appendicular skeleton, tibia has precarious blood supply due to inadequate muscular envelope. Tibial fractures may be associated with compartment syndrome, vascular or neural injury. The presence of hinge joints at the Knee and the ankle, allows no adjustment for rotatory deformity after fracture. Because of the high prevalence of complications associated with these fractures, management is often difficult and the optimum treatment method remains controversial. Management of the fractured tibia requires the widest experience, greatest wisdom and the best of clinical judgment in order to choose the most appropriate treatment for a particular pattern of injury.[1] Among the various modalities of treatment such as conservative gentle manipulation and use of short leg or long leg cast, open reduction and internal fixation with plates and screws, intra medullary fixation (including Ender Pins, intramedullary nails, and interlocking intramedullary nails with (or) without Reaming), and External fixation techniques, surgeon should be capable of using all these techniques and must weigh advantages and disadvantages of each one and adapt the best possible treatment. The best mode of management should be determined by considering the morphology of the fracture, the amount of energy imparted to the extremity, the mechanical characteristics of the bone, the age and general conditions of the patient, and most importantly the status of the soft tissues. Three important factors to be considered for the better outcome of the management of tibial fractures are prevention of infection, the achievement of bony union, and the restoration of function. Immobilization in a plaster cast has been used most commonly in the past, but it does not always maintain the length of the tibia and it leaves the wound relatively inaccessible. Open reduction and internal fixation with plates and screws has yielded unacceptably high rates of infection.[2,3] This method may be selected with more severe or local injuries associated with displaced intra articular fractures of knee and ankle. External fixation, considered the treatment of choice by many traumatologists, has the disadvantages of bulky frames and frequent pin tract infections, non-unions, and mal-unions.[2,4] Intra medullary nailing, locked or unlocked has become an attractive option since image intensifier has made closed intramedullary nailing possible. Nail is a load sharing device and is stiff to both axial and torsional forces. Closed nailing involves least disturbance of soft tissue, fracture haematoma and natural process of bone healing as compared to other forms of internal fixation. Intramedually nails, such as Lottes and Ender nails, used without reaming, have been employed successfully in the treatment of open tibial fractures and have been associated with low rates of postoperative infection. They are, however contraindicated for comminuted fractures, as there tends to be shortening or displacement of such fractures around these small nails. The locking of intramedullary nails to the major proximal and distal fragments decreases the prevalence of mal-union of comminuted fractures. Until recently, however, all interlocking

[1]Assistant Professor, Department of Orthopaedics, Tagore Medical College and Hospital, [2]Professor and H.O.D, Department of Community Medicine, Tagore Medical College and Hospital, chennai, India

Corresponding author: Dr. Vijay Baba. N, 648-D, 1st Floor, D- Sector, W-Block, 8Th Street, Anna Nagar West Extn, Chennai 600101, India

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intramedullary nailing involved reaming, which destroys the endosteal blood supply.[5] In view all these factors this study was done with the objective of assessing the outcome of the closed tibial fracture management by intramedullary nailing.

Aims and objectives

To study the clinical and radiological outcomes of Interlocking intramedullary nailing in the management of closed tibialdiaphyseal fractures in terms of–

a. Time required for union.
b. Range of movements of knee and ankle joints.
c. Rate of mal-union.
d. Rate of non-union

To assess the factors associated with the outcome of surgical management of tibialdiaphyseal fractures by IL-IM nailing.

MATERIAL AND METHODS

This study was done in the department of Orthopaedics in Meenakshi Medical College and Research Institute, Enathur, kanchipuram. This study was done for period of 2 years among patients attending the Orthopaedics. Outpatient department and casualty. The study participants presented and diagnosed as closed tibial diaphyseal fractures were admitted to the hospital after fulfilling the inclusion and exclusion criteria as given below. A total of 20 patients fulfilled the inclusion and exclusion criteria and these patients were informed about the surgical procedure and the informed consent were obtained for participating in the study, ensuring the confidentiality. Institutional ethical clearance was obtained before starting the study.

Inclusion Criteria

1. Patients of age between 20 – 60 years.
2. Both Males and Females.
3. Closed fractures.

Exclusion Criteria

1. Patients of age less than 20 years and more than 60 years.
2. Fractures with Segmental loss of bone.
3. Compound fractures
4. Diaphyseal fractures extending into ankle and knee joint.
5. Pathological fractures.

Surgical Technique: Patients were operated under spinal / general anaesthesia. Patient was placed in supine position over a radiolucent operating table. The injured leg was positioned freely, with knee flexed 90º over the edge of operating table. We did not use tourniquet in our patients.

Determination of Nail Length: We measured the length of nail by using the guide wire. The exposed length of the guide wire is subtracted from its total length of 950 mm.

Determination of Nail Diameter: The diameter is determined based on the size of last reamer used. A nail measuring 1 mm smaller than the last reamer is used.

Procedure: A vertical midline incision is used. The patellar tendon is split in the midlne. After selecting the point of insertion a curved bone awl is used to breach the proximal tibial cortex. A ball tip guide wire of 3 mm diameter x 950 mm length is passed into the medullary canal antegradely across the fracture site after closed reduction with image intensifier guidance. Serial reaming is done in increments of 1 mm. A nail of the measured length and diameter which is 1 mm less than the last reamer is mounted in the jig and negotiated down the medullary canal and across the fracture. The distal locking is done by free hand technique with the help of image intensifier. Proximal locking with one or two screws is done using the jig.

Post-Operative Care: Active knee, ankle and toe mobilization is started when patient recovers from anesthesia. All the patients in our series were allowed non weight bearing standing on the 1st post op day except in 2 patients who had associated upper limb fractures. In all our patients sutures were removed on the 11th or 12th postoperative day. Partial weight bearing was commenced depending upon the type of fracture, rigidity of the fixation and associated injuries. Further follow up was done at 4 weekly intervals and each patient was individually assessed clinically and radiographically according to the proforma. The outcome of the study was assessed by the following methods:

Functional Results: Detailed analysis of function of the patient was done on the basis of the following criteria by Klemm – Borner et al[6], 1986.

Excellent

- Full knee and ankle motion
- No muscle atrophy
- Normal radiographic alignment

Good

- Slight loss of knee and ankle motion (<25º)
- Less than 2cms of muscle atrophy
- Angular deformity of <5º

Fair

- Moderate (25º) loss of knee or ankle motion
- More than 2 cms of muscle atrophy
- Angular deformity of 5-10º

Poor

- Marked loss of knee or ankle motion (> 25º)
- Marked muscular atrophy
- Angular deformities > 10º

STATISTICAL ANALYSIS

The outcomes were measured in terms of Excellent, Good, Fair and Poor and the Chi – square test was done as test of significance. The general socio- demographic variables and the fracture related risk factors were assessed in statistical analysis.

RESULTS

The present study includes 20 closed fractures of the tibial shaft surgically treated with closed interlocking intramedullary nailing from June 2009 to May 2011 in the Department of Orthopaedics at Meenakshi medical college hospital and RI, Enathur. The patients were followed up for an average of 13months. All except one patient was available for follow up at the close of this study. Majority of the patients were from age group 20 – 39 years (90%). The youngest patient was 22 years old and oldest patient was 60 years. Majority of the patients were male (75%) and only 25% were female patients. The major mode of injury in our study was road traffic accident. The predominant tibial fracture pattern was oblique (40%).Majority of fractures occurred at middle and distal third (95%).In our study most of the cases were associated with fibula fracture. In most of the

patients PWB was started on 21 to 30 days postoperatively. Ten patients were progressed to protected FWB at 8 to 12 weeks postoperatively. Of the remaining 10 cases full weight bearing was started at 4-8 weeks in 2 patients and after 12 weeks in 8 patients. Secondary procedure in the form of dynamisation of the nails was done in 15% of patients, usually between 12-16 weeks. In one case we did bone marrow injection at 14 weeks. One case developed deep wound infection for whom despite a trial of IV antibiotics for 6 weeks infection failed to subside and hence wound debridement followed by nail removal and external fixation was done sequentially. Following this the fracture did not show any progress to union for 5 months before being lost to follow up. The end results of all 20 cases are summarized here. All the cases had a follow up ranging from 4 to 28 months (Table-1).

1. Union: Nineteen of the 20 fractures united. The time to union ranged from 12 to 32 weeks with an average of 20 weeks. Fourteen fractures united before 20 weeks and 5 fractures united between 20 to 30 weeks. The one case of non-union secondary to deep infection was lost to follow up 5 months after the secondary procedure (Table-1).

2. Range of movements: In 13 patients (65%) full Range of knee motion was attained in 12 weeks. Less than 25º loss of knee motion was noted in 5 cases. In two patients more than 25º loss of knee motion was noted**.** In 15 patients (75%) full range of ankle motion was attained in 12 weeks. Less than 25º loss of ankle motion occurred in 4 cases. In one case there was more than 25º loss of ankle motion (Table-1).

3. Mal-union: Varus angulation was noted in one case which was less than 7.5º.

4. Infection: One patient developed superficial wound infection andone patient developed deep wound infection.

5. Anterior Knee pain: In our study 3 patients (15%) complained of pain at the knee joint. The results of our study under the above categories are as follows, 13 cases (65%) had excellent results.5 cases had good results (25%) and two cases (10%) had poor results (Table-1).

In our study, statistical analysis proved that, "type of fracture" showed a p value less than .05 which is significant, whereas the other variables like age, gender, mode of injury, associated fibula fracture, mode of locking were not associated with the outcome of the surgery (Table-2).

DISCUSSION

Age Distribution: The average age of all cases in my study was 31.35 years. The fracture was more common in the age group of 20 – 39 years. Other similar studies had similar age distribution as of our study, Whittle et al[7] in a study of 50 cases of fractures of tibia reported an average age of 34 years. Singer and Kellam[8] had an average of 36 years in their study of 43 tibial shaft fractures. In another study of 72 fracture of tibia conducted by Bonatuset. Al[9], the average age was 30.3 years (Table-1).

Sex Distribution: There were 15 male and 5 female patients showing male preponderance. Bonatus et al showed a sex distribution of 52 men and 19 women in their study while Singer and Kellam et Al had 30 males and 11 females in their study (Table-1).

Variables	Frequency and percentage
Sex	
Male	15 (75%)
Female	5 (25%)
Age	
Below 34	13 (65%)
Above 34	7 (35%)
Mode of injury	
Fall	3 (15%)
Fall of weight	2 (10%)
Road traffic accident	15 (75%)
Side	
Left	9 (45%)
Right	11 (55%)
Level	
Distal 1/3rd	6 (30%)
Middle 1/3rd	13 (65%)
Upper1/3rd	1 (5%)
Type	
COmminuted	2 (10%)
Oblique	8 (40%)
Spiral	4 (20%)
Tranverse	6 (30%)
Fibular fracture	
Yes	15 (75%)
No	5 (25%)
Locking	
Dynamic locking	5 (25%)
Static locking	15 (75%)
Secondary procedures	
Bone marrow injection	1 (5%)
Dynamisation	3 (15%)
Nil	15 (75%)
Anterior knee pain	
No	17 (85%)
Yes	3 (15%)
Knee range of movements	
$0\text{-}80^0$	1 (5%)
$0\text{-}100^0$	1 (5%)
$0\text{-}120^0$	3 (15%)
$0\text{-}130^0$	2 (10%)
FULL	13 (65%)
Ankle range of movements	
$0\text{-}30^0$	1 (5%)
$0\text{-}50^0$	4 (20%)
Full	15 (75%)
Union	
12 -20 Weeks	14(70%)
20-30 Weeks	5(25%)
Non union	1(5%)
Result	
Excellent	13 (65%)
Good	5 (25%)
Fair	0
Poor	2 (10%)

Table–1: Showing Frequency distribution of the study participants

Mode of injury: In our studythe major mode of injury was road traffic accidents accounting for 10 cases. Three patients sustained fracture after a fall and two patients sustained fracture due to fall of heavy object on the leg. In a study by Bonnevialle P et al[10] out of 38 patients studied there were 25 motor vehicle accidents (17 two-wheel, 8 four-wheel), 5 sports accidents, 2

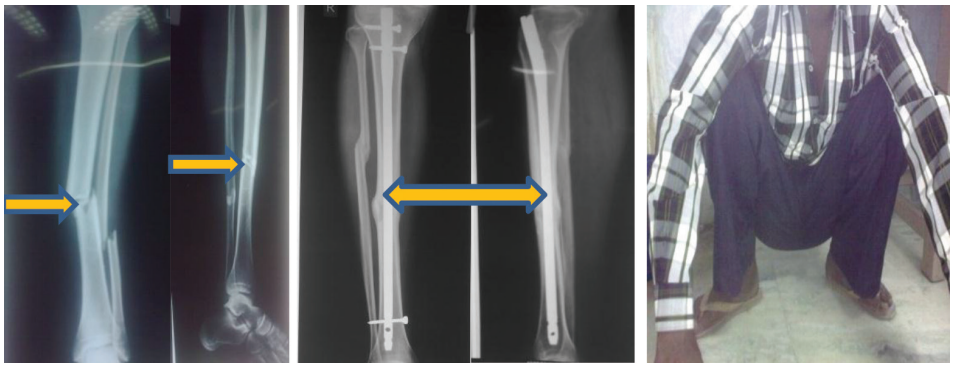

Figure-1: Depicting a 35 year male – pre op x-rays showing fracture of both bones right leg middle third, sustained due to fall of weight; postop x-rays showing good union at 14 months follow up; postop clinical pictures shows patient having full ROM of knee and ankle

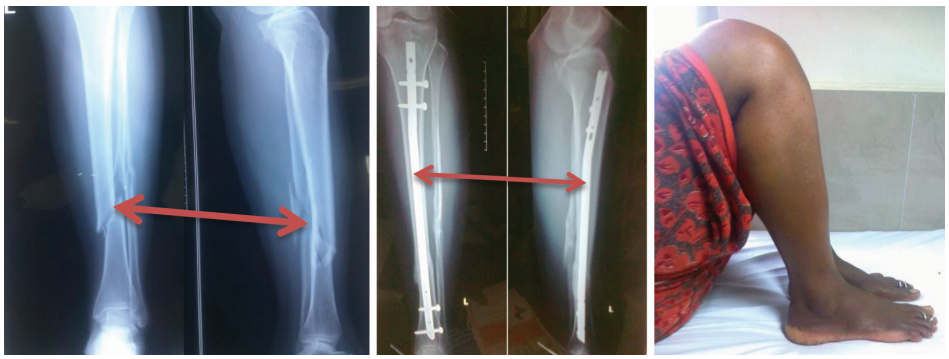

Figure-2: Depicting a 22 year female pre-op x-ray showing fracture of distal third of both bones of left leg sustained in a RTA; post-op x- rays showing complete union of fracture at one year follow up; post-op clinical pictures showing full ROM of knee at one year follow up

Variables	Excel	Good	Poor	P-value
Sex				
Male	10	4	1	0.684
Female	3	1	1	
Moi				
Fall	0	2	1	0.125
Fow	2	0	0	
Rta	11	3	1	
Side			1	
Left	6	2	1	0.962
Right	7	3		
Level				
D/3	4	2	0	0.324
M/3	9	2	2	
U/3	0	1	0	
Type				
Comm	1	1	0	0.043
Oblq	8	0	0	
Spiral	0	3	1	
Tran	4	1	1	
Fib				
Yes	8	0	0	0.166
No	5	5	2	
Anaes				
Ea	10	4	2	0.743
Ga	1	1	0	
Sa	2	0	0	
Locking				
Dynamic	3	1	1	0.684
locking	10	4	1	
Static				
locking				

Table–2: Showing the distribution of variables versus outcome of the surgery

home falls, and 6 others (Table-1).

According to E.A.Nicollet al[11] the final outcome of surgical management of tibial fractures is directly proportionate to the severity of initial trauma which inturn is determined by the degree of initial displacement, comminution and soft tissue injury. As per the above study the more severe the fracture, the higher the rate of complications and longer the period of healing, whatever the method of fixation used.

In the current study of 20 cases of closed fractures of the shaft of tibia who were treated by closed reamed interlocking intramedullary nailing followed up for an average of 13 months showed excellent out come in terms of rate of union, range of movements and relatively less rate of mal-union and Infection.

CONCLUSION

Our study has proved that Closed reamed interlocking intramedullary nailing is a fairly good option in the management of most closed diaphyseal fractures of the Tibia. The investigator adopted early mobilization, simpler follow up, avoiding repeated visits, frequent plaster changes and check radiographs which paved the way for obtaining such a moderately better results.

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