IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 14, Issue 8 Ver. III (Aug. 2015), PP 52-56
www.iosrjournals.org

Management of Open Tibial Shaft Fractures Treated By Primary Intramedullary Interlocking Nailing

Dr. B. Mohan Choudhary[1], Dr. Sadem Amer[2], Dr. R. Dorai Kumar[3,]
Dr. Pravin K Vanchi[4]
1,2,3,4 (Department of Orthopaedics, Sri Ramachandra University, Chennai, India)

Abstract: *Our study was aimed at analyzing the clinical and radiological outcome following "Primary Intramedullary Interlocking Nailing in the treatment of Open Tibial Shaft Fractures". It was a prospective study done over a period of about 3 years analyzing 31 patients in total. Our inclusion criteria was open tibial fractures classified under the gustilo and Anderson classification from grade I – grade IIIB. Grade IIIC fractures and non unions, tibial fractures not treated primarily by intramedullary devices were excluded from the study. The average age of the 31 patients was 37 years and majority being males at 28 of them. 6 patients had other associated injuries. 1 patient had a segmental tibial fracture and 12 had comminuted tibial fractures. The average union time was 24.4 weeks, in which grade I and II was at 19.4 weeks and grade IIIB was 30.5 weeks. The average infection rate was at 11.6%. Our patients functional outcome was based on the Johner's and Wruh's criteria in which 58.6% had excellent results and 22.05% had good outcome. Only 2 patients had a poor outcome functionally. Complications encountered was nonunion which was at 11.8% and infection at 11.6%*

Keywords: *open fractures, trauma, lowerlimb, open tibial-nailing, orthopaedics.*

I. Introduction

As industrialization and urbanization are progressing year by year, with rapid increase in road traffic, the incidence of high energy trauma are increasing with the same speed exponentially. Tibial fractures are the most common long bone fractures encountered by most of the Orthopaedic surgeons and majority of them are compound fractures.Since one third of the tibial surface is subcutaneous, open fractures are more common in tibia than in any other long bone. Furthermore blood supply of tibia is more precarious than that of bones enclosed by bulky muscles.

The most important causes of tibial fractures are road traffic accidents, sports injuries, direct blows or assault, fall and gunshot injuries. The important factors in prognosis are (1) amount of initial displacement of fractures, (2) degree of comminution, (3) signs of infection (4) severity of soft tissue injury.Because of the high prevalence of complications associated with these fractures, management is often difficult, and the optimum method of treatment remains as a subject of controversy[1].

"The primary objective in the management of an open fracture is union with prevention or eradication of wound sepsis." -Gustilo et.al[2].

Every fracture is an individual problem and the decision to treat it by internal fixation or external fixation should be based on a realistic assessment of the advantages and hazards of each method in the circumstances of that particular case. Management of tibial fractures requires widest experience and the best of clinical acumen in order to choose the most appropriate treatment for a particular pattern of fracture.

Among the various modalities of treatment such as closed reduction and application of POP cast, open reduction and internal fixation with plates and screws, intramedullary fixation (interlocked intramedullary nailing, Enders nails, etc.) and external fixation techniques, surgeon must be capable of doing all these techniques and must weigh the advantages and disadvantages of each one and adopt the best possible treatment. The best treatment should be determined by a thoughtful analysis of morphology of the fracture, the amount of energy imparted to the extremity, the mechanical characteristics of the bone, age and general condition of the patient and most importantly the status of the soft tissues (skin, muscle, etc) and associated neurological and vascular status of the leg.

Three goals must be met for the successful treatment of open tibial fractures: (a) Prevention of infection, (b) Achievement of fracture union (c) Restoration of function. These goals are interdependent and usually are achieved in the chronological order given. For example failure to prevent infection promotes delayed union or non-union and delays the functional recovery of the limb.

Immobilization of the limb in a plaster cast has been most commonly used in the past but it does not always maintain the length of the limb and it leaves the wound relatively inaccessible. Open reduction and internal fixation with plates and screws has yielded unacceptably high rates of infection. This method may be opted with more severe or local injuries, associated displaced intra articular fractures of knee and ankle.

External fixation, which was considered as the treatment of choice by many Orthopaedic surgeons, has the disadvantages of the 1) bulky frames, 2) frequent pin track infections, 3) nonunion and 4) malunion. With the invention of interlocked intramedullary nails all these above said goals and complications were well addressed. Nail is a load sharing device and is stiff to both axial and torsional forces. Closed nailing involves least damage to soft tissues, fracture haematoma and natural process of bone healing as compared to other forms of internal fixation. The locking of intramedullary nails to the major proximal and distal fragments decreases the incidence of malunion of comminuted fractures. The use of titanium nails has improved the rate of fracture union and decreased the rate of infection considerably.

II. Aim

To evaluate the clinical and radiological outcome of "Primary Intramedullary Interlocking Nailing in the treatment of Open Tibial Shaft Fractures"

III. Materials And Methods

This study was done at the Department of Orthopedic Surgery, Sri Ramachandra Medical College and Research Institute during the course period of April 2009 till Oct 2011.It is a prospective study. 34 open tibial shaft fracture cases were analyzed out of which 3 lost follow up. Of the 31 cases 3 were female and 28 were male. The average follow up was for 1 year.

3.1 Inclusion criteria

- Extra articular Open tibia fractures with/without fibula fracture except grade-IIIC
- Age above 18 years
- Grade I, II, IIIA & IIIB.
- Open tibial fractures with associated injuries
  - Head injury
  - Other fractures
  - Other soft tissue injuries

3.2 Exclusion criteria

- Open Tibial fracture treated primarily with external fixation.
- Non union of tibial fractures.
- Intra-articular fractures.
- Closed tibial fractures.
- Grade IIIC fractures

3.3 Age incidence

Patients' age ranged from 18 to 70 years. Average: 37

Age in yrs	No. of Patients
11 – 20	1
21 – 30	14
31 – 40	4
41 – 50	8
51 – 60	1
61 – 70	3
TOTAL	31

3.4 Sex incidence

In our series, males predominated with the ratio of 9:1.

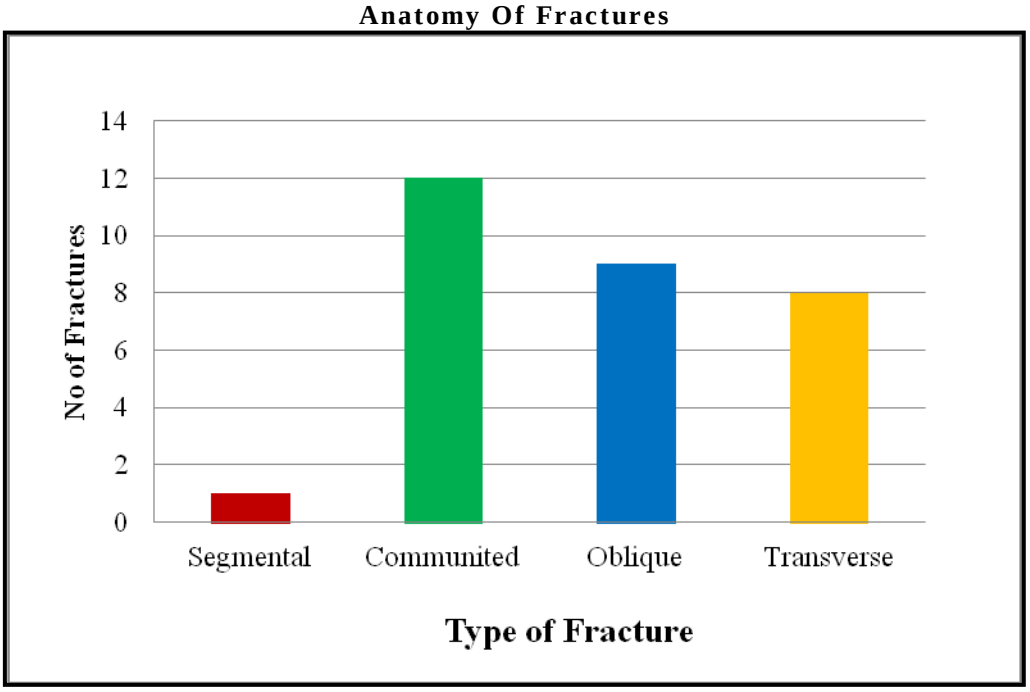
Sex	No. of Patients
Male	28
Female	3

3.5 Associated injuries: 23% of our patients had associated injuries

Injuries / Fractures	**No. of Patients**
Head Injury	2
Posterior dislocation hip	1
Tibial Plateau fracture / Galeazzi fracture	1
Metatarsal fracture	1
Distal radius fractures	1

3.6 Anatomy of fractures

In our study we had 1 case of segmental fracture, 12 fractures were comminuted, 9 cases had oblique pattern and 8 cases had transverse type of fractures.



3.7 Classification of soft tissue injuries

We classified the open fractures of tibia according to Gustilo and Anderson et al classification. Among 31 patients:

Grade II	-	15
Grade III A	-	12
Grade III B	-	4

IV. Results & Discussion

Thorough wound debridement and external skeletal fixation along with or without soft tissue cover was earlier the established treatment for open tibial fractures despite the problems of mal-union and pin-track sepsis associated with its use. In early years intramedullary nailing using un-reamed unlocked nails had produced good results in type III open tibial fractures but that method did not adequately stabilize comminuted or segmental fractures. Then with improved metallurgy and advances in nail design there were extensive studies on the use of primary nailing and primary soft tissue cover. As a result the use of reamed interlocking nailing (J.F.Keatings Et al) in open tibial fractures the treatment for the same has become more simplified without increasing the rate of infection[3]. This eventually results in early return to work and reduced morbidity and length of hospital stay to the patient. Recently treatment for open tibial fractures have evolved into a stage where primary nailing and immediate/early soft tissue cover[4] has become the method of treatment.

In our hospital immediate wound debridement and POP immobilization followed by elective interlocking nailing is the routine for grade I and grade II open tibial fracture. But it is associated with multiple surgical procedures and long hospital stay.

Wound debridement and External fixation followed by repeat wound debridement and elective delayed primary cover followed by internal fixation is the method of treatment for grade III fractures. To assess the functional outcome of those patients with open tibial fractures treated with primary nailing +/- soft tissue cover we have conducted this prospective study in our hospital.

We have done 34 cases out of which we lost the follow up of 3 patients. We have analyzed union, infection and functional outcome in the remaining 31 patients. There were 28 males and 3 females in the study. The average age of the patients was 37 years. We assessed the time to union, infection rate, rate of malunion, non-union and the need for secondary procedures. In our study average time to union was 24.4 weeks (grade II – 19.4 wks, grade IIIA - 23.3 wks, gradeIIIB – 30.5 wks).

Average Union Time

Author	Treatment	Union time (weeks)	
		III A	III B
Blick et al (1989)	External fixation	38.6	47
Court- brown et al (1990)	External fixation	26.5	47.4
Court-brown et al (1991)	Intramedullary nailing	27.2	50.1
Our study	Intramedullary nailing	24.3	27.5

Grade II fractures results were comparable with the previous studies (Averaging 23.5 wks in Court-Brown et al).Two required dynamisation and another required dynamisation and bone grafting. In grade III fractures union time is marginally better than with the previous studies (24.3 weeks vs 27.2 weeks Court-Brown et al).

Comparing with other studies our union rate was better. Infection was noted in 4 patients(11.8%) of which 2 were superficial (Gr. II-1 and Gr IIIA-1) and deep infection in 2 patients of Grade IIIB of which repeat wound debridement, implant removal and LRS fixation done and other Patient for which the same has been done. The infection rate in our study when compared to other studies was comparable. Three of them were (GrII-1,GrIIIA-1,GrIIIB-1) taken up for surgery after twenty four hours following injury with no primary wound care was given in the earlier treated medical centre. Probably this delayed primary wound care could have been the reason for infection.

Union Time And Infection Comparison

Study	Treatment	Union time(weeks)	Infection (%)
Our study	Interlocking nailing	24.1	11.6
Blick et al(1990)	External fixation	45.2	9.5
Court-brown (1990)	External fixation	36.7	17.6
Court-brown (1991)	Interlocking nailing	38.2	11.1

There were four cases of Gr IIIB for which additional procedures such as flap cover (either Fascio-cutaneous or Myo-cutaneous) was done in all of them and secondary bone grafting was done in two of them. Two of the patients had varus mal-alignment of the fracture. They went on for delayed union and finally union was achieved at 28 and 30 weeks respectively with secondary bone grafting. Two patients with Gr-IIIB injuries required additional bone grafting as they went on to delayed union. Their union was eventually achieved at 31 and 33 weeks respectively There was limb length discrepancy in two patients which were managed by compensatory heel and sole raise footwear.

Our patients were followed up regularly and were assessed using the Johner and Wruh's criteria. The results were categorized as excellent, good, fair and poor. There were 18 patients with excellent outcome (58.06%), 7 had good outcome (22.05%), 4 had fair outcome (12.9%) and two had poor result(6%).

Comparitive Studies

Study	Infection	Non union
Megraw et al 1988	44%	54%
Maurer et al 1998	25%	35%
Our study	11.8	11.8%

Study	Treatment	Nonunion
Our study	Interlocking nailing	11.8%
Clifford et al 1997	External fixation and delayed cover	23.8%
J. F keatings et al 1997	Primary Interlocking nailing and delayed cover	12%
Sanders et al 1994	Primary Interlocking nailing and delayed cover	17%

D Joshi A Ahmed, L Krishna, Y Lalin 2004 reviewed their cases of open tibial fractures treated with unreamed Interlocking ailing, They found similar results of infection and Non Union with unreamed nailing. They encountered 3.6% of nail breakage and 14.3% of screw breakage in their study. We did not encounter any such problem. Our infection rate 11.6% and Nonunion rate was 11.8%. In this study the infection rate was 11.6% and nonunion rate was 11.8% as shown below.

Complication	Joshi A Ahmed et al	Our study
Infection	10.7%	11.6%
Non union	10.7%	11.8%
Nail Breakage	3.6%	Nil
Screw Breakage	14.3%	Nil

Hamza et al reported three infections after the treatment of twenty-two open fractures[5] and Smith subsequently reported six infections in eighteen patients[6]. Klemm and Borner reported six infections after treatment of Ninety- three grade-I open tibial fractures with insertion of a locking nail after reaming[7]. Bone and Johnson reported two infections after treatment of eight Grade-II and Grade-III fractures with nailing after reaming[8]. In our study of 31 patient of reamed interlocking nailing we had 4 cases that were infected.

Infection	Total number of patients	Infection
Hamza et al 1971	22	3
Smith et al 1974	18	6
Klemm and Borner 1986	93	6
Bone and Johnson 1986	8	2
Our study 2011	31	4

With improvement in the surgical debridement, effective antibiotic coverage, early flap cover and better metallurgy the infection rate in compound fracture have reduced considerably.

V. Conclusion

The treatment of open tibial shaft fracture has evolved over the last two decades. Improved wound care, newer generation antibiotic and better metallurgy for the implants have contributed to this change. Now, the present trend in the management of such fractures is primary wound debridement, skeletal stabilization and primary soft tissue cover.

We have followed such a similar protocol in this study of 31 patients with open tibial fractures. In this study we achieved union at an average of 24.1 weeks. (Grade –II 19.4 weeks, Grade- IIIA -23, Grade-IIIB- 30.5 weeks) In this study there were 18 patients with excellent outcome (58.06%**)**, 7 had good outcome (22.05%), 4 had fair outcome (12.9%) and two had poor result (6%). We had an infection rate of 11.6%. The non-union rate in our study was 11.8%.

Primary would debridement, inter-locking nailing and primary flap cover for our patients with open tibial fracture is the preferred treatment of choice for such challenging fractures.

References

[1]. Giannoudis PV, Papakostidis C, Roberts C. A review of the management of open fractures of the tibia and femur. VOL. 88-B, No. 3, March 2006;281-9
[2]. Gustilo RB, Anderson JT. Prevention of infection in the treatment of on thousand and twenty five open fractures of long bones: retrospective and prospective analyse. JBJS Am 1976;58:453-458
[3]. Keating JF, Blachut PA, O'Brien PJ, Court-Brown CM.Reamed Nailing Of Gustilo grade-IIIb Tibial Fractures JBJS Vol 82-B, No.8, November 2000,1113-1116.
[4]. Smith, J.E.M.: results of early and delayed internal fixation for tibial shaft fractures. A review of 470 fractures. J. Bone and joint Surg., 56-B(3): 469-477,1974.
[5]. Hamza, K. N.; Dunkerley,G. E.; and Murry, C. M. M.: fractures of the tibia. A report on fifty patients treated by intramedullary nailing. J. Bone and Joint Surg., 53-B (4): 696-700, 1971
[6]. Smith, J.E.M.: results of early and delayed internal fixation for tibial shaft fractures. A review of 470 fractures. J. Bone and joint Surg., 56-B(3): 469-477,1974.
[7]. Keating JF, O'Brien PJ. Locking intramedullary nailing with and without reaming for open fractures of the tibial shaft: a prospective, randomized study. JBJS (AM) 1997;79-A:334-41
[8]. Bone, L.B., and Johnson, K.D.: treatment of the tibial fractures by reaming and intramedullary nailing. J. Bone and joint Surg., 68-A: 877-887, July 1986.