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Evaluation of functional result in different grades of compound tibial fractures by intramedullary nail

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Abstract

Background: The purpose of the present study was to evaluate the outcomes of compound fractures of tibia shaft managed by interlocking intramedullary nailing.

Methods: This is a retrospective study of 20 patients with open fractures of tibia shaft operated primarily by tibia interlocking nail.

Results: In Our Study we had 20 patients with open tibial fractures. Majority of patients in our series were under 40 years of age with an average age of 28.6 years. The youngest patient was 17 years old and the eldest patient was 55 years. Majority (80%) of our cases sustained Tibial shaft fracture in road traffic accidents. Out of 20 cases in our series in 7 cases (35%) middle 3rd of tibia was involved and in 9 cases (45%) it was lower 3rd. Most common radiological pattern of fracture in our series was transverse (55%) followed by oblique in 30% and comminuted in 15%. In Patel series most common pattern was oblique 50%, transverse in 31% and comminuted in 19%. In our study, 70% cases were operated within 2 weeks of injury. Earliest case was operated on 3rd day of injury. Supplementary / secondary procedure required in our series were dynamization (required in 15% of our cases) and bone grafting (5%), none of our cases required nail removal with plating and bone grafting or exchange nailing. One patient required nail removal as he developed deep infection. 75% of our patients were ambulatory within 2 weeks of operation in the form of non weight bearing crutch walking. Of the remaining 5 patients 2 had shaft Femur fracture, one had contralateral both bone leg, one had surgical neck of Humerus with undisplaced Tibial plateau and last one had wound complication. In our series 75% cases showed signs of satisfactory radiological union by 20 weeks. In 50% of our cases clinical and radiological union occurred in 20 weeks' time. There was no incidence of non union in our series. Our series did not include compound grade III fracture rest all series mentioned here included this in their study. Average time of union came out to be 24.8 weeks with minimum of 16 weeks and maximum of 30 weeks. In 10 patients union occurred in >20 weeks (delayed union). 2 were those patients who underwent dynamization, one had underwent bone grafting, one patient had contralateral both bone leg and one patient was 55 years old. In rest 5 patients no obvious cause was found. Delayed union was more in distal 1/3rd fracture due to precarious blood supply. In our study out of 20 patients operated by Tibia interlocking nail 4 (20%) excellent, 6(30%) Good, 10(50%) fair functional results.

Conclusions: Treatment of open tibial fracture remains controversial. But the early debridement, primary wound closure and interlock nail is a good option in compound tibia fractures.

Keywords: Evaluation, functional, grades, compound, fractures, nail

Introduction

Mankind since Stone Age has been inventing means of transportation. Speed has always fascinated mankind and quest for higher speed has exposed him to dreadful vulnerability of high speed trauma. Now trauma is an unavoidable event of life. With rapid increase in traffic in India (number of registered vehicle in 2001-54991 to 141866 thousand in 2011) [1]. There has been a dramatic increase in road traffic accidents. India witnesses one road traffic accident every minute. A life is lost every 3.7 min in these accidents [2]. Fracture of tibia have become one of the commonest fracture encountered in high velocity trauma [3]. These fractures are frequently open and contaminated as tibia lies subcutaneously. Moreover due to poor blood supply and inadequate soft tissue coverage has made tibial fracture particularly prone to infection, delayed union, malunion, non-union and rarely amputation [4]. All these make tibial fracture a complicated one to treat.

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Over the years a number of methods have evolved for the management of various types of fractures and the surgeon must be aware of the advantages, disadvantages and limitation of each to select the proper treatment of each patient. The type & location of fractures, the degree of comminution, the age of patient, the patient's social and economic demands & other factors that may influence the method of treatment must also be kept in mind.

Possible methods of treating fractures of tibial shaft includes following:

Conservative method

1. Closed reduction and immobilization
2. Skeletal traction
3. Cast bracing

Operative method

1. External fixation

- a. Tubular type
- b. Ring fixator
- c. Hybrid fixator

2) Internal fixation

- a. Intra medullary nailing
 - Locking, no locking
 - Reamed, undreamed
- b. Plate & screw fixation

Aims and Objectives

1. To study the prevalence of open tibial shaft fracture with reference to age, sex and side of involvement.
2. To evaluate the clinical, functional and radiological results of primary intramedullary locked nailing in the management of open tibial fractures.

The results of treatment were evaluated using following criteria

Factors	Grade 'A'	Grade 'B'	Grade 'C'
1. Pain at fracture site	None	Moderate	Severe and pain at rest
2. Complications			
A) Infection	Nil	Minor infection (Superficial)	Chr osteomyelitis (Deep)
B) Neurovascular	Absent	Minor	Major
Restriction of movement (% loss)			
i) Knee	None	<25%	>25%
ii) Ankle	None	<25%	>25%
C) Position of fragment at uni	<1/5 th of cortex displaced	1/5 th -1/3 rd	>1/3 rd
D) Angulation (in degree)	<5	5 - 10	>10
E) Shortening	<1cm	1-2cm	>2cm
F) Muscle atrophy	Minimal	Moderate	Marked
3. Time of union	12 – 16wk	16 – 20wk	>20 wk
4. Difficulty in walking	None	Mild symptom (Pain during climbing stairs)	Severe symptom (Patient has to use walking aid)

Based on table results were graded as: -

Excellent- All factors were of grade "A"

Good – Except for one or two factors graded "B" rest all are "A"

Fair – One factor as "C" rest all are "A or B"

Poor- More than one factor was graded "C"

Observation

The present study included 20 cases of open Tibial shaft fractures of grade I and II, which were managed by intramedullary locked nailing in department of orthopaedics at B.R.D medical college, Gorakhpur. The patients have been followed up for a maximum of 9 months. Following observations were made

Materials and Method

This study was undertaken in Department of orthopedics B.R.D. medical college and Nehru hospital on patients of compound fracture Tibia admitted from September 2012 to May 2013.

Selection of Patients

Inclusion Criteria

1. Compound tibial shaft fracture grade I, II.
2. Fracture lying distal to tibial tuberosity and 4cm proximal to ankle joint.
3. Fracture of less than 4 week duration from day of injury.

Exclusion Criteria

1. Tibial fracture with intra articular extension.
2. Open grade IIIA, B, C fracture.
3. Pathological fractures.
4. Malunion and nonunion.

Implant Choice

We generally prefer reamed Cannulated nail for compound grade I, unreamed solid for grade II.

Postoperative Care

Limb was elevated, analgesics and antibiotics were started. Injectable antibiotics was continued for a week and then patient were kept on oral antibiotics until stitches were removed. Gradual non weight bearing exercises were started from 2nd post op day depending upon tolerance of patients.

Appropriate physiotherapy instituted. Stitches were removed after 10–14 days of surgery.

Patients were followed up at 6 weekly interval and progress was recorded till fracture had united

Range of knee movement at final follow up

Range	Number of cases	%
Full	17	85
90 - 120	2	10
<90	1	5
Any loss of extension	-	-

Range of ankle movement at final follow up

Range	Number of cases	%
Full	14	70
<25% loss	6	30
>25% loss	-	-

Complications

Complications		Number of cases	%
Pain at fracture site (noted at time of clinical and radiological union)	None Moderate Severe	18 2 -	9010-
Infection (noted during follow up)	None Superficial Deep	1721	85105
Neurovascular (after surgical procedure)	None Moderate Severe	20 - -	100--
Deformity (noted at time of clinical and radiological union)	None Moderate Severe	164-	8020-
Difficulty in walking (noted at time of clinical and radiological union)	None Moderate (pain during climbing stairs) Severe (patient use walking aid)	173-	8515-
Complications specific to treatment	Nail breakage Nail bending Screw breakage	---	---

Overall grading (based on criteria described in material and methods)

Criteria	Number of cases	%
Excellent	4	20
Good	6	30
Fair	10	50
Poor	-	-
Total	20	100

Discussion

The type & location of fractures, the degree of comminution, the age of patient, the patient's social and economic demands & other factors that may influence the method of treatment must also be kept in mind. Over the years a number of methods have evolved for the management of various types of fractures and the surgeon must be aware of the advantages, disadvantages and limitation of each to select the proper treatment plan for each patient.

Majority of patients in our series were under 40 years of age with an average age of 28.6 years. The youngest patient was 17 years old and the eldest patient was 55 years. In S. Patel *et al.* series mean age was 32.6 years. Ronald singer and James treated 43 cases with an average age of 37 years. Mean age group common to most of series is around 30 years. This is due to the fact is exposed to maximum activity and thus are more prone to accidents.

Majority (80%) of our cases sustained Tibial shaft fracture in road traffic accidents. In S. Patel series 88.6% cases were because of road traffic accidents and in Singer and James series RTA contributed to 66.2% of their cases. Maximum injuries occurred due to road traffic accident which is common to all the series. In Indian theses percentages are high because of more use of two wheeler transportation and bad roads.

Out of 20 cases in our series in 7 cases (35%) middle 3rd of tibia was involved and in 9 cases (45%) it was lower 3rd. In S. Patel series these figures were 7.14% for upper 3rd, 42.86% for middle 3rd, and 50% for lower 3rd. For Court Brown *et al.* 4.8% upper 3rd, 36.87% middle 3rd, 51.2% lower 3rd. Our series, Patel series and even the western series constantly show higher percentage of fractures in middle and lower third of Tibia, which stands as the most exposed part of leg and is involved directly in road traffic accident.

Most common radiological pattern of fracture in our series was transverse (55%) followed by oblique in 30% and comminuted in 15%. In Patel series most common pattern was oblique 50%, transverse in 31% and comminuted in 19%. In Ekland *et al.* most common pattern was Transverse 42% then oblique in 27%, comminuted in 20% and 11% showed segmental fracture. Our series and Ekland *et al.* series showed higher percentage of transverse fracture while Patel series showed higher percentage of oblique fracture. Neither our series nor Patel series showed segmental fracture whereas

11% of Ekland *et al.* series showed segmental fracture this is probably because of more high speed accidents in western world. In our study, 70% cases were operated within 2 weeks of injury. Earliest case was operated on 3rd day of injury. Shaphered and Williams treated 33 patients of open tibial fracture with severe soft tissue injury with nailing and muscle flap coverage for soft tissue defects. His average time from injury to initial procedure was 16.7 hours (4-40hours). 76.7% of his cases were operated within 24 hours of trauma.

Supplementary / secondary procedure required in our series were dynamization (required in 15% of our cases) and bone grafting (5%), none our cases required nail removal with plating and bone grafting or exchange nailing. One patient required nail removal as he developed deep infection. In series of Shaphered and Williams 13 of 31 patients (42%) required secondary procedures to promote fracture union. 7 required dynamization, 4 required bone grafting and 2 required nail removal with compression plating and bone grafting. In Singer and James series 21% cases required dynamization, 4.5% bone grafting and 25.6% cases required exchange nailing. Dynamization was done in cases of axially stable fracture which showed minimal callus formation even after 3 months of operation. Dynamization was done in 3 patients following which patients were allowed weight bearing on PTB cast or brace till union occurred. 75% of our patients were ambulatory within 2 weeks of operation in the form of non weight bearing crutch walking. Of the remaining 5 patients 2 had shaft Femur fracture, one had contralateral both bone leg, one had surgical neck of Humerus with undisplaced Tibial plateau and last one had wound complication. In our series 75% cases showed signs of satisfactory radiological union by 20 weeks. In 50% of our cases clinical and radiological union occurred in 20 weeks time. There was no incidence of nonunion in our series. Our series did not include compound grade III fracture rest all series mentioned here included this in their study. Average time of union came out to be 24.8 weeks with minimum of 16 weeks and maximum of 30 weeks. In 10 patients union occurred in >20 weeks (delayed union). 2 were those patients who underwent dynamization, one had underwent bone grafting, one patient had contalateral both bone leg and one patient was 55 years old. In rest 5 patients no obvious cause was found. Delayed union was more in distal 1/3rd fracture due to precarious blood supply.

Our series showed least incidence of infection as compared to S. Patel series and other series of western world. Superficial infection was present in 10% cases, deep infection in 5%.

Only 2 patient in our series developed knee pain as compared to 6 of 29 patients in Hooper *et al.* series. Out of these one patient had direct knee trauma which resulted in haemarthrosis another had slight nail protrusion. Malunion of <5degree angulation in coronal and sagittal plane is seen in 20% cases whereas one case has >5 degree of varus angulation. No case of rotational deformity. 20% of our cases

showed excellent results as compared to 63% for Patel series and 90% for DAGA series. Excellent results were less in our series as compared to other series. The main limiting factor was union time. There were more cases of delayed union in our series.

Case 1



Case 2



Conclusion

1. Of every 8 cases of trauma admitted in our department one had fracture Tibial shaft. Of these 55% were open fractures.
2. Maximum number of fractures occurred in age group of 15-35 years. Mean age group was 28.6 years. Males were affected in 85% of cases and the most common mode of injury was road traffic accidents (80%).
3. A transverse radiological pattern was encountered most frequently (55%). Gustilo type I were most frequent in our study (70%). Majority of patients in our series had fracture of lower 2/3rd of Tibia. Fracture of shaft of femur was the most common associated major boney injury.
4. The technique of closed intramedullary nailing is simple, requires minimal surgical trauma with negligible blood loss. The technique provided the advantage of early knee and ankle mobilization, early ambulation, better patient compliance, early union time, decreased complications like infection (15%), nonunion (0%) as compared to other modalities.
5. In our series 85% cases had full range of knee movement and 70% cases had full range of ankle movement. None of cases had extension lag.
6. In our series 20% had excellent result, 30% had good result, 50% had fair result but none had poor result.
7. Intramedullary nailing of tibial fracture offers a cheap, simple, superior to other conventional method, easily available, does not require any specialized tools, suiting to our operating condition and highly effective means of treatment of Tibial shaft fracture, which falls in a high percentage of injuries to skeletal system.

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