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## To evaluate the functional and radiological outcome of compound tibia shaft fracture treated with primary interlocking nail

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### Abstract

**Introduction:** The Tibial shaft fracture are most common seen in road traffic accidents, Degree of displacement of fractures, degree of comminution, signs of infection and severity of soft tissue injury are the most important prognosis factors. Nail is a load sharing device with stiffness in both torsional and axial forces. Least damage to soft tissues is done by closed interlocking nailing.

**Aim:** To evaluate the functional and radiological outcome of Compound Tibia shaft fracture treated with primary interlocking nail.

**Method:** The present study was conducted in the department of Orthopaedics of SRMS-IMS, Bareilly from 2017-2020 on 20 patients, Extra articular Open tibia fractures with/without fibula fracture, Age above 18 years, Grade I, II & IIIA (Gustilo Anderson's classification). Exclusion criteria: Open Tibial fracture treated primarily with external fixation, Non union of tibial fractures, Intra-articular fractures, Closed tibial fractures, Grade IIIB & IIIC fractures (Gustilo Anderson's classification). standard surgical procedure of intramedullary interlock nailing of tibia was done. regular follow up was done with clinical and radiological assessment and final results made using Modified Ketenjian and Shelton Criteria.

**Result:** 85% of the cases were male, with 55% grade 1, 40% grade 2 and 5% grade 3A. 60% cases were due to RTA. 55% of cases had middle third fracture tibia, 70% of cases were operated within 48 hours, the mean union time was 20 weeks by then full weight bearing walker walking was started. 20% of patient showed superficial infection which got resolved by regular dressing, with 1 case of delayed union and 2 cases of stiffness. at the end of 6 months 70% showed excellent, 25% good and 5% satisfactory results.

**Conclusion:** The fractures in our study united in an average of about 20 weeks. This one time procedure of Interlocked intramedullary nailing done which lead to union in almost all the cases. This procedure allows earlier fracture union hence early weight-bearing. Because of the high union rate and low infection rate, we consider closed interlocking nailing as the best mode of treatment for compound diaphyseal tibial fractures upto Gustilo-Anderson grade 3A.

**Keywords:** Evaluate, functional, radiological outcome, shaft fracture, interlocking nail

### Introduction

The most common long bone fractures is the Tibial shaft fractures out of which approximately 63% of tibia fractures are open fractures [1]. Open fractures are more common in tibia due to its one third surface is subcutaneous than in any other long bone. As tibia is one of the large bone of the body and one of the major load bearing bones in lower extremity, following fractures it can lead to prolonged morbidity, extensive disability until treatment is appropriately given. Infection and non union chances increased as it is a subcutaneous bone [2].

The Tibial shaft fracture are most common seen in road traffic accidents, sports injuries, fall from height/stairs, assault/direct blow and gunshot injuries. Degree of displacement of fractures, degree of comminution, signs of infection and severity of soft tissue injury are the most important prognosis factors.

Twice the amount of contamination are seen in open tibia fracture as compared with other areas. Good results have been achieved following serial wound debridement with early soft tissue cover over the fracture site [3].

For the successful treatment of open tibial fractures three goals must be met which are:- Prevention of infection, fracture union and functional restoration [4]. The disadvantages of the external fixator which initially were the treatment of choice are- heavy frames, risk of pin track infections, nonunion and malunion.<sup>3</sup>

Nail is a load sharing device with stiffness in both torsional and axial forces. Least damage to soft tissues is done by closed interlocking nailing [5].

The method of choice for fixation of these fractures is Interlocking nailing [4]. Early debridement and unreamed interlock nailing act as an important modality for management of open fractures of tibia. At the time of unreamed nail insertion with smaller size of tibial nails can lead to increased rate of nail or screw breakage [6].

The present study has been taken to review the results of compound tibial shaft fracture with primary interlocking nail.

### Materials and Methods

The present study was conducted in the department of Orthopaedics of SRMS-IMS, Bareilly from 2017-2020 on 20 patients having compound tibial shaft fracture after obtaining approval from Hospital Ethics Committee.

### Inclusion criteria

- Extra articular Open tibia fractures with/without fibula fracture
- Age above 18 years
- Grade I, II & IIIA (Gustilo Anderson's classification)

### Exclusion criteria

- Open Tibial fracture treated primarily with external fixation.
- Non union of tibial fractures.
- Intra-articular fractures.
- Closed tibial fractures.
- Grade IIIB & IIIC fractures (Gustilo Anderson's classification)

All the protocols and procedures in this study as per guidelines of ethics committee of this institution.

All the patients of Tibia fracture came to us either at the casualty or Orthopaedic outpatient department and assessment for vascular and neurological status was done.

### Method of Treatment

#### Initial Management and Resuscitation

The wound over the fracture site was cleaned and dressed and an above knee slab was applied by simply aligning the bone. Other wounds, if any, were taken care of appropriately. The patient once settled from the acute injury, was shifted to the Orthopaedic ward.

#### Implants and Instrument

A complete set of IL-nails from 28-38cm length available in 7, 8, 9,10 mm diameter. An Osteotome, Hammer and Periosteum elevator, diamond - tip bone awl, aluminium tissue protector, nail-extractor, Hand/Power drill and drill bits of 3.2mm, Depth gauge, bone tap and 4.5 mm cortical screw set, Hexagonal tipped screw drive, tourniquets, Image intensifier television, Reamer and Guide wire.

#### Description of IL-Nail

Interlock Nail was used in all of the cases. Interlock nail which is hollow, and metallic having a D-shaped surface at its

proximal end and a proximal locking hole. It has proximal bent of 20° in anteroposterior direction to compensate for the proximal Herzog's curve within the medullary canal. The nail has a slot along its whole length on the posterior direction which facilitates unreamed nail insertion. About 2.5cm above the tip of the nail is a distal locking holes in the anteroposterior direction.

A suitable length of the nail is chosen by measuring from the tibial tuberosity to the base of the medial malleolus on the unaffected side. The diameter of the nail is decided according to the size of medullary canal on the X-ray or by reaming

### Intramedullary nailing of tibial shaft fracture

Standard operating table used, measurement of rotation done, Entry portal was made by making a 3-cm incision along the medial border of the patellar tendon, extending from the tibial tubercle in a proximal direction. Using bone awl entry was made and guide wire was passed into the medullary canal after fracture reduction under c- arm, reaming of the canal done, nail of appropriate size passed through the tibia and proximal and distal bolts tightened, fracture reduction confirmed under c-arm. Wound closed in layers and aseptic dressing done.

Weight bearing was restricted until early callus occurs and then was progressed as tolerated in fractures without axial stability and those at the proximal or distal metadiaphyseal junction. Partial weight bearing with iron walker started. Full weight-bearing was advised on the basis of pain and the stability of the fracture fixation

**Follow-up and Evaluation:** The patient is usually followed up at 3<sup>rd</sup> week, 6<sup>th</sup> week, 12<sup>th</sup> week and 6<sup>th</sup> month. X-rays were taken at every visit and patient was assessed clinically for union of fracture.

Functional Results were assessed on the basis of Ketenjian and Shelton Criteria modified by Yokoyama *et al.* [7].

### Modified Ketenjian and Shelton Criteria

**Excellent:** No notable abnormality

**Good:** Occasional pain with prolonged use  
Joint motion 75% of normal  
Trivial swelling  
Normal gait

**Fair:** Pain with ordinary activity  
Joint motion 50% of normal  
Small amount of swelling  
Slight limp

**Poor:** Constant pain  
Joint motion < 50% of normal  
Any visible deformity  
Limp, gait on cane or crutches

### Observations

The present study of 20 patients with compound tibia shaft fracture treated with primary interlocking nail. The aim of the study was to evaluate the radiological and clinical outcome of management of compound tibia shaft fracture with primary interlocking nail. This study includes 20 patients who were admitted to the Orthopedics Wards of SRMS-IMS Bhojipura Bareilly UP.

The study included patients 18 years and above in age and more than half of the cases were below 35 years of age. There seemed to be a decreasing incidence of injury with age. Mean age of patients was 33.35 ± 10.01 years.

**Table 1: Grade of fracture**

| Grade of fracture | Number | Percentage (%) |
|-------------------|--------|----------------|
| Grade i           | 11     | 55             |
| Grade ii          | 8      | 40             |
| Grade iii         | 1      | 5              |
| Total             | 20     | 100            |

Out of 20 Cases included in the study. Among compound fractures Grade I -Gustilo's (55%) were more while Grade - II Gustilo's (40%) and Grade- III(5%).fracture tibia with grade-1

were more as compared to others.

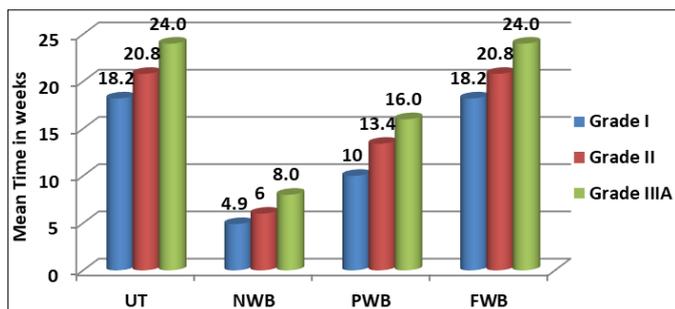
**Table 2: Injury to surgery interval (ISI)**

| Injury to surgery interval (ISI) | Number    | Percentage (%) |
|----------------------------------|-----------|----------------|
| <48hrs                           | 14        | 70             |
| > 48hrs                          | 6         | 30             |
| <b>TOTAL</b>                     | <b>20</b> | <b>100</b>     |

Injury to surgery interval (ISI) was maximum in 14(70%) patients at <48hrs

**Table 3: Correlation in Grade of Fracture in different variables**

|                   | Radiological union time (In weeks) | Non weight bearing (In weeks) | Partial weight bearing (In weeks) | Full weight bearing (In weeks) |
|-------------------|------------------------------------|-------------------------------|-----------------------------------|--------------------------------|
| Grade of fracture | <b>Mean</b>                        | <b>Mean</b>                   | <b>Mean</b>                       | <b>Mean</b>                    |
| Grade I           | 18.2                               | 4.9                           | 10.0                              | 18.2                           |
| Grade II          | 20.8                               | 6.0                           | 13.4                              | 20.8                           |
| Grade IIIA        | 24.0                               | 8.0                           | 16.0                              | 24.0                           |



**Fig 1: Mean time in weeks**

Average Radiological union time was minimum 18.2 weeks in Grade I fracture, 20.8 weeks in Grade II fracture and 24.0 weeks in Grade III A. Average non weight wearing time was minimum 4.9 weeks in Grade I fracture, 6.0 weeks in Grade II fracture and 8.0 weeks in Grade III A. Average Partial weight wearing time was minimum 10.0 weeks in Grade I fracture, 13.4 weeks in Grade II fracture and 16.0 weeks in Grade III A. Average Full weight wearing time was minimum 18.2 weeks in Grade I fracture, 20.8 weeks in Grade II fracture and 24.0 weeks in Grade III A.

**Table 4: Functional assessment at 6<sup>th</sup> month according to Modified Ketenjian and Shelton criteria modified by Yokoyama**

| Follow up at 6 month | Number | Percentage (%) |
|----------------------|--------|----------------|
| Excellent            | 14     | 70             |
| Good                 | 5      | 25             |
| Satisfactory         | 1      | 5              |
| Total                | 20     | 100            |

Result was excellent in maximum 14(70%) patients, good in 5(25%) patients and satisfactory in 1(5%) patients at 6 month of follow up.

**Table 5: Complication**

| Complication     | Number | Percentage (%) |
|------------------|--------|----------------|
| Delayed union    | 1      | 5              |
| Infection        | 4      | 20             |
| Wound dehiscense | 1      | 5              |
| Stiffness        | 2      | 10             |

Out of 20 patients 14(70%) had no complication and only 1(5%) patient had delayed union,1 patient (5%) had wound dehiscense with infection, 1(5%) patient had knee stiffness

with infection,2(10%) patient had superficial infection and 1(5%) patient had knee stiffness.

**Case record**





## Discussion

The present study of 20 patients with compound tibia shaft fracture treated with primary interlocking nail. The aim of the study was to evaluate the radiological and clinical outcome of management of compound tibia shaft fracture with primary interlocking nail.

Kaushik *et al.* [1] in there study reported cases range from 20-40 years, O.W.Chang *et al.* [8] reported the age range from 17-70 years which was comparable to present study in which the age group was range 21-55 years. In our present study the mean age of the patient was 33.35 years comparable with Rao. M.N *et al.* [5] in which it was 34.75 years. D Joshi *et al.* [9] in there study founded the average age of 30 years. Chauhan N *et al.* [10] reported 36.2 years, Jain. V *et al.* [11] reported an average age of patients in there study was 40.3 years.

According to Grade of fracture, Jain V *et al.* [11] reported grade 1 fracture in majority of the cases followed by grade 2 and grade 3A as compared to our study. D Joshi *et al.* [9] reported morphology of fracture classified according to the classification of Gustilo- Anderson for open fractures in which 53.6 were type 1, 32.1 were type 2 and 7.1 were type 3A and 3B. In our study grade 1 - 55% was found to be more common than grade 2 and grade 3.

According to Injury to surgery interval in the present study

70% of cases were operated in less than 48 hours followed by 30% in more than 48 hours, Kumar *et al.* [12] reported mean injury to surgery interval as 14.54 hours, Idumagdobi. A *et al.* [13] reported in there study injury to surgery interval of mean 5.1 days, 3 days by Rathwa M Y *et al.* [14].

According to Weight Bearing in present study we started non weight bearing from 4-8 weeks out of which 85% of the cases non weight bearing was started in 4-6 weeks as compared to D Joshi *et al.* [9] who reported mean non weight bearing period 8.2 weeks range from 6-14 weeks. Rao N M *et al.* [5] reported in there study that in majority of the patients partial weight bearing was started at 4 weeks(50%), ranging from 4-12 weeks. As compared to our study in which partial weight bearing was started in 65% of patients within 8-12 weeks ranging from 8-16 weeks. The average duration of partial weight bearing was 12 weeks.

Idumagbod. A *et al.* [13] in there study commenced full weight bearing at the mean of 8 weeks ranging from 6-12 weeks, Kumar *et al.* [12] reported 12-16 weeks, Chauhan N *et al.* [10] reported 18 weeks. In our present study 60% of the cases full weight bearing was started at 16-20 weeks with average duration of full weight bearing was 20 weeks.

According to Radiological union in present study in 60% of the patients radiological union was achieved at 16-20 weeks and 40% of patients 20-24 weeks compared to Babu S.N.A *et al.* [15] reported union time 20.90 weeks, Sriram.TT *et al.* [16] reported 20.25 weeks, Choudhary M B *et al.* [17] reported 20.4 weeks, Chauhan *et al.* [10] reported average union time 20.13 weeks as compared to present study in which it was 20 weeks.

According to Functional outcome Based on functional outcome by Ketenjian and Shelton Criteria modified by Yokoyama *et al.* [7] we recorded 14 cases (70%) Excellent and 5 cases (25%) Good results as compared to Agarwal A *et al.* [18] reported 18 cases (60%) Excellent, 7 cases (23.4%) Good results. Kumar *et al.* [12] reported in there study excellent in 75%, good in 14.28% comparable to our study. Joshi *et al.* [9] in there study reported 89.28% (25) as excellent to good results compared to present study as 95%.

According to Complications In our study superficial infection rate was 20% in the initial stages and it healed with dressings and antibiotics. Klemm and Borner [19] in a study reported an infective rate of 6.4%, and a study conducted by Bone and Johson [20] reported an infective rate in grade1 as 4.7%, in grade 2 as 10.5% and in grade 3 as 25%. A study conducted by Court Brown *et al.* [21] reported an infective rate of 12% and 8% in grade 1 and 2 respectively.

We encountered 1case of delayed union. The reason in the cases was probably communitated fracture of tibia. A study conducted by Puno *et al.* [20] in 1986 analyzed the incidence of delayed union and non union in tibial fractures treated by intra medullary nailing reported a 1.7% cases with delayed union. a study conducted by Melcher [22] in 1993 used AO unreamed tibial nail and reported a case of non union (5%).

Court Brown *et al.* [21] conducted a study in 1996 did a comparative study of reamed and unreamed tibial nails and reported 20% incidence of non union with unreamed AO-unreamed tibia nailing while none with reamed Grosse-Kempf nail. In our study we came across with 5% case of delayed union which is comparable to other studies.

## Conclusion

In our study we investigated the outcomes of closed interlocking tibia nail in 20 patients with compound tibia diaphyseal fractures which were followed up for six months of time period. The fractures in our study united in an average

of about 20 weeks. This one time procedure of Interlocked intramedullary nailing done using image intensifier which lead to union in almost all the cases. This procedure allows earlier fracture union hence early weight-bearing with less morbidity. Because of the high union rate and low infection rate, we consider closed interlocking nailing as the best mode of treatment for compound diaphyseal tibial fractures upto Gustilo-Anderson grade 3A.

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