

OPERATIVE OUTCOME OF TIBIAL DIAPHYSEAL FRACTURE IN ADULT POPULATION: A PROSPECTIVE STUDY OF 40 CASES

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Abstract

Background: Fracture of the shaft tibia is one of the commonest fractures in adults. Treatment modalities for shaft tibia fractures are decided according to the type of fracture, age group, and bone density. Operative management of diaphyseal fractures has been widely accepted. Re-establishing length, alignment, and rotation with stable fixation are the goals of operative intervention to allow an early range of motion and ease in continuing daily living activities. **Materials and Methods:** We included 40 patients treated with various operative techniques in the study. Operative techniques include open reduction internal fixation with plating and close reduction internal fixation with intramedullary nailing. Acute diaphyseal fractures of the tibia based on AO/OTA classification with a minimum of 12 months of follow-up are included. Proximal and distal intra-articular fractures are excluded. **Result:** The present study consists of 40 patients. 30 patients (75%) were treated with close reduction & 10 patients (25%) were treated with open reduction. We had excellent results in 75% of cases, good in 20%, and fair in 5%. **Conclusion:** Our analysis results of both close reduction and open reduction are the same. Closed reduction and internal fixation with intramedullary nails reduce operative time and chances of sepsis. Open reduction and internal fixation with plating show fewer chances of delayed union and pain at the front of the knee joint.

INTRODUCTION

Fracture of the shaft tibia is one of the commonest fractures in adults. Tibia fractures occur due to high-energy trauma mostly due to road traffic accidents and industrial accidents.^[1]

Tibia is frequently exposed to injury due to its location. One-third of surfaces are subcutaneous so there is an increased chance of open-grade fracture.

Treatment modalities for shaft tibia fractures are decided according to the type of fracture, age group, and bone density. Conservative treatment has previously been regarded as the standard treatment for low-energy tibia shaft fractures.

For treatment of shaft tibia fracture interlocking nailing is preferred. In nailing insertion point is distal from the site of traumatized tissues.^[2]

Minimally invasive percutaneous plates are another method of treatment for shaft tibia fracture. Minimally invasive percutaneous plating provides stability and minimizes any intraoperative iatrogenic

soft tissue damage.^[3-4] This study aims to determine the effects of “operative outcome in shaft tibia fracture”.

MATERIALS AND METHODS

This study was carried out at our institute. Patients of shaft tibia fracture were included in this study with prior informed consent.

40 patients who have sustained fracture of the shaft tibia including AO classification 41A1, 41A2, 41A3, 42B2, 42B3, [Table 1] and a case of Gustilo & Anderson,^[6-8] classification grade I, grade II compound injury were operated on from December 2020 to June 2022 and they were followed up at regular interval with minimum six months up to two years. The analysis started after taking approval from the institutional review board

Inclusion criteria

- Patients above 18 years

- AO classification 41A1, 41A2, 41A3, 42B2, 42B3 and Gustilo & Anderson classification grade I, grade II fracture of shaft tibia.^[5]

Exclusion Criteria

- Patient <18 years
- Grade III open fracture
- Pathological fracture
- Compartment Syndrome with late presentation

The patients were received in the trauma ward and after initial hemodynamic stabilization and treatment for associated injuries, they were assessed clinically and radio-logically for definitive treatment. Each fracture is classified by using the AO Fracture classification system.^[5]

Patients were operated on after medicine and anesthesia fitness of the patient. All patients were given a supine position following anesthesia on a radiolucent tabletop to facilitate the use of an image intensifier. A pneumatic tourniquet /Esmarch rubber tourniquet was used in all patients. Cases in which the fibula was fixed in addition to nailing or plating of the tibia, were done either with a one-third semi-tubular plate, a reconstruction plate, or a rush nail.

Infra patellar approach was used for intramedullary nailing.

The standard approach for the MIPO technique is medial. However, in selected cases with soft tissue lesions on the medial side, an anterolateral approach can be used. This MIPO approach is used for extraarticular type A fractures, or simple, minimally displaced, intraarticular type C fractures.

In the distal tibia, the plate is normally applied on the anteromedial aspect.

Follow-up of the patients was done at 1 month, 3 months, and 6 months. Clinical assessment is done at every visit with a radiograph for fracture union.

Pre-injury mobility, fracture pattern, medical status regarding fitness, delay in operation, and total hospital stay were recorded.

Intra-operative data like type and quality of reduction, type of implant with details, time of operation, incision size, and fluoroscopy were recorded. Postoperatively complications if any, starting of mobilization, and severity of pain were noted.

In every follow-up visit patients were assessed clinically, radiologically, and functionally with movements of the knee and ankle, shortening of limb, and gait. Radiographs were taken to assess the union. Assessment is done based on Tegner Lysholm Knee Scoring Scale, Alho and Ekland criteria,^[9,10] Ollerude, and Molander scoring system for ankle

RESULTS

The present study consists of 40 patients. Patients of age groups between 18 to 55 years were included. 65% of the Patients were between 18 to 45 years [Table 2].

In the study, 27 Patients (67.5 %) were male and only 13 patients (32.5%) were female.

We found that tibia shaft fracture is more common on the right side (60%) as compared to the left side. 65% of patients had closed fractures, 20% of patients had compound fracture type I, and 15% of patients had compound fracture type II.

20 patients (50%) had a complete (transverse) fracture. 7 (17.5%) patients had the spiral type of fracture, 5 patients (12.5%) had angular (oblique) fracture, 4 patients (10%) had compression (wedge) fracture and four cases (10%) had severely comminuted fracture [Table 1].

15 patients (37.5%) had mid-shaft tibia fractures while 16 patients (40%) had distal 3rd tibia shaft fractures & 9 patients (22.5%) had injuries over the upper 3rd tibia.

28(77.7%) patients had fibula fractures with the same level of tibia shaft fracture, 8 (22.3%) patients had fibula fractures with different levels of tibia shaft fracture and 4 patients had no fibula fracture.

25 patients were treated within 4 days. 12 patients were treated within 7 days and 3 patients were treated after 7 days due to other illness.

29 patients (72.5%) had a hospital stay of 7 days or less, and 9 cases (22.5%) had a hospital stay of 10 days or less. 2 patients (5%) had hospital stays of more than 10 days due to other medical illnesses.

30 patients (75%) were treated with close reduction & 10 patients (25%) were treated with open reduction.

30 patients (75%) were undergone closed nailing [Figure 1] & 10 patients (25%) were treated by ORIF by plating [Figure 3].

Around 55% (22 cases) of patients had operated within 61 to 80 mins. Around 22.5% (9 cases) of patients had operated within 80 to 100 min. Operative time was found to be higher in 9 cases with 101-120 mins.

2 (5%) patients had superficial skin infections, and 1 patient (2.5%) had deep infection.

Partial weight bearing was started with the help of a walker. The average duration of partial weight bearing was 4 weeks.

The appearance of a bridging callus was used to assess and allow the patient full weight bearing. time of walking without support ranges from 6 to 10 weeks.

Full weight bearing has been delayed in a few patients in comminuted fractures & associated injury.

In 37 (92.5%) patients union was seen in 20 weeks. With an average of 16.72 weeks, fractures were united.

38 patients' clinical assessment and check x-ray shows union between 12 weeks to 20 weeks, 2 patients' x-ray shows union in 21 weeks to 24 weeks, and 1 patient shows x-ray changes of delay in a union.

All the patients were assessed for a minimum of 10 months. 72.5% of the patients (29) were assessed for

more than one year, and 27.5% of the patients (11) were assessed for less than a year.

On the final follow up 6 patients had anterior knee pain; 4 patients had fracture site pain occasionally.

37 patients (37%) had flexion of the knee joint exceeding 120 degrees, and the rest of the cases had 120 degrees.

36 patients (90%) had Full extension of the knee but 4 patients had a 10-degree extension lag.

34 patients (85%) of the patients had ankle dorsiflexion >20 degrees & 6 patients (15%) had ankle dorsiflexion of less than 20 degrees.

38 patients (95%) had planter flexion >30 degrees & 2 patients (5%) had planter flexion 30 degrees.

37 patients (92.5%) had painless locomotion, and 3 cases had occasional difficulty.

Up to the final follow up 38 patients can squat easily & 2 patients had difficulty in squatting.

37 patients (92.5%) can sit cross-leg and 3 cases (7.5%) had difficulty in cross-leg sitting.

32 patients (80%) had resumed their duties after surgery within 16 – 24 weeks & 8 patients (20%) had returned to the workplace more than 24 weeks.

35 patients had implants in situ, one patient had removal of implant & 4 patient had screw removal.

We had excellent results in 75% of cases, good in 20%, and fair in 5%



Figure 1: 30-year-old male patient having right side upper-end tibia fracture (AO 42B3) treated with 16-hole LC-DCP by MIPO technique.

Statistical Analysis

The functional outcome graded as Excellent, Good, Fair, and Poor based on the Olerud and Molander

scoring system and a Chi-square test gave a p-value of 0.0250 indicating that there was statistical significance in the functional outcome of the two management modalities in a study by Sagnik Mukherjee et al,^[11] outcome observed using Karlstrom and Olerud score after 24weeks (mean± standard error) (30.55± 0.57) (p=0.867) [Table 4].



Figure 2: Clinical Follow-up



Figure 3: 21 years old male patient of shaft tibia fracture (AO42C3) treated with interlocking nail



Figure 4: Clinical Follow up

Table 1: AO/OTA classification

42A (SIMPLE)	42A1 – SPIRAL	7
	42A2 – OBLIQUE	5
	42A3 – TRANSVERSE	20
42B (WEDGE)	42A1 – SPIRAL WEDGE	
	42B2 – INTACT WEDGE	3
	42B3 – FRAGMENTARY WEDGE	1
42C (MULTIFRAGMENTARY)	42A1 – SPIRAL	0
	42C2 – INTACT SEGMENTAL	0
	42C3 – FRAGMENTARY SEGMENTAL	4

Table 2: Age Distribution

Sr. No.	Age Group (year)	No. Of Patients	Percentage
1.	18-25	6	15%
2.	26-35	12	30%
3.	36-45	8	20%
4.	46-55	8	20%
5.	>55	6	15%
	Total	40	100%

Table 3: Functional Outcome

Results	No. of Patients	Percentage of cases
Excellent	30	75%
Good	8	20%
Fair	2	5%
Poor	0	0

Table 4: Statistical Analysis

Study	Score & Outcome (mean± standard error)	P value
Sagnik Mukherjee et al, ^[7]	Olerud and Molander scoring system (84±2.57)	0.025
Niaz Hussain Keerio et al, ^[18]	Karlstrom and Olerud score (30.55± 0.57)	0.867
Our study	Olerud and Molander scoring system	0.383

DISCUSSION

Nowadays high energy velocity trauma and industrial accidents lead to an increase in the number of long bone fractures in the lower limb.

Our study aims to evaluate the operative outcome of shaft tibia fracture.

In open-grade tibia shaft fracture I & II with the use of injectable antibiotics, we were able to operate our cases which helped in preventing any infection.

There are several methods of treatment for the fractured shaft of the tibia. Some people apply above knee cast after closed reduction till clinical union occurs. Nowadays lower limb trauma by and large is operated for restoration of functional outcome and early mobilization.

40 Patients with tibia shaft fractures were treated surgically with tibia interlocking nails and locking plates. Patients above 18 years were included in this study with male predominance.

The average time of operative procedure for close reduction and internal fixation was 75 minutes by Ji J et al,^[12] and the average time of open reduction internal fixation by Cheng W et al,^[13] was 87±25.7 minutes.

Union in tibial interlocking nailing was 14.755±0.69 weeks, with 19.38±1.39 weeks for open reduction and internal fixation plating and 16.78±0.78 weeks overall.

In a study by Saied A et al,^[14] the time of union was averaging 4.30±1.48 months in the plating group and 4.34±1.45 months in the case of close reduction internal fixation, removal of the interlocking screw was done in 4 (12%) of the patients. Vallier HA et al,^[15] show the average time for union of shaft tibia fracture for all patients was 18 weeks.

In patients treated with intramedullary nailing pain at the knee joint was observed in six patients (15%). in a study by Katsoulis E et al,^[16] pain at the knee was observed in 10% to 86% of patients. Pain management was done through analgesic and physical therapy.

loss of movement was noted in 1 (2.5%) case of close reduction and 2(5%) cases of open reduction internal fixation. Loss of movement at the knee joint was subtle in close and open procedures. There was a 10° and 5° reduction of movement at the ankle joint in close and open procedures respectively. Lefavre KA et al,^[17] showed a reduction in ankle

joint ion in 19 (57.6%) cases, and in 6.1% of cases shows reduced knee movements.

The study by Vallier,^[15] 2012 found that 95% of patients returned to work irrespective of plating or nailing. 77% of IM nailing returned to moderate to heavy work vs 71% plating and 31% had modified their work post-injury in our study all patients returned to work within 12 months.

The intramedullary interlocking nail group of patients had encountered pain in the front aspect of the knee joint. Nowhere shows discernible justification for the weight-bearing protocol after shaft tibia fractures. The usual universal protocol shows movements to be initiated immediately postoperatively and progress to walking.

Our analysis results of both close reduction and open reduction are the same. Closed reduction and internal fixation with intramedullary nails reduce operative time and chances of sepsis. Open reduction and internal fixation with plating show fewer chances of delayed union and pain at the front of the knee joint.

CONCLUSION

The results are assessed based on Alho and Ekeland Criteria showed excellent outcomes in 30 patients (75 %) and good outcomes in 8 patients (20 %) and fair outcomes in 2 patients (5%).^[9,10]

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