

# Functional Outcome of Internal Fixation of Fibula by Closed Tens Nailing in Addition to Tibia in Distal Both Bone Leg Fractures

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## Abstract

**Introduction:** Treatment of adult tibiofibular fractures, especially severely comminuted fractures, is technically challenging due to the lack of reduction markers and difficulty in restoring the alignment. Fixation of the fibula can facilitate the reduction of the tibia fracture and restoration of the lower extremity alignment.

**Aim:** This study aims to study the functional outcome of internal fixation of fibula by closed tens nailing in addition to tibia in distal both bone leg fractures.

**Materials and Methods:** Patients with distal both bone leg fractures for whom fibular fixation was done in addition to tibia nailing in Government Rajaji Hospital, Madurai from July 2016 to September 2018 with a minimum 1-year follow-up were included in the study.

**Results:** In this study among 15 patients, 9 patients did not have any angulation, 6 patients had varus angulation with mean varus of 2°, and none of the patients had valgus angulation. The mean range of movements in patients with fibula fixation was 96%. The mean time of union in these patients was 5 months (minimum of 4 months and a maximum of 7 months). Johner and Wruch's criteria: Among the 15 patients, 12 patients (80%) had excellent results and 3 (20%) had good results. There were no fair and poor results.

**Conclusion:** Treatment of distal third both bone leg fractures by fixation of fibula by closed tens nailing in addition to the tibia is useful in anatomical reduction of tibia and reduced malalignment of tibia with good ankle functions. Further randomized control studies are needed to assess the long-term functional outcome in these patients.

**Key words:** Ankle functions, Fibula fixation, Imil nailing, Tens nail, Tibial malalignment

## INTRODUCTION

Tibial diaphyseal fractures are one of the most common long bone fractures encountered.<sup>[1,2]</sup> The distal third region accounts for about 20–30%.<sup>[1,3-5]</sup> Fractures in the distal third of both bones leg when treated by conservative line of management, there are high chances of malunions,<sup>[1,2]</sup> ankle stiffness due to prolonged immobilization, delayed union, valgus or varus malalignment.

Schoot *et al.* followed up 88 patients with fracture of the distal third of leg with attention to angular deformity,

osteoarthritis of the knee, ankle, and any other residual complaints.<sup>[6]</sup> They showed positive relation between the degeneration process in knee and ankle with malalignment of tibia.<sup>[7-10]</sup> They opined that fractures of the distal third of the leg should be managed so that the possibility of angular deformity should be minimized and thereby minimize late arthritis.

Intramedullary interlocking nailing appears to be one of the good treatment options available due to various advantages such as fewer wound complications, less malunion, early weight-bearing, and early motion.

The anatomical reduction seems to be needed to reduce malaligned tibia which results in ankle and knee arthritis. As the deformity approaches either of the joints, malalignment leads to maldistribution of articular surface pressures that may predispose to premature osteoarthritis.<sup>[11]</sup>

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To study the clinical relevance of fibular fixation by closed tens nailing in addition to the tibia in distal third fractures of both bones of leg and in an effort to outline the advantage and benefits of fixation of the fibula, this study was undertaken.

**Aim**

This study aims to study the functional outcome of internal fixation of fibula by closed tens nailing in addition to tibia in distal both bone leg fractures.

**MATERIALS AND METHODS**

This prospective study was conducted in the Department of Orthopaedics at Madurai Medical College and Rajaji Hospital. Patients with distal both bone leg fractures for whom fibular fixation was done in addition to tibia nailing from July 2016 to September 2018 with a minimum of 1-month of follow-up were included in this study.

**Inclusion Criteria**

The following criteria were included in the study:

- Simple distal both bone leg fractures
- Compound Grade I fractures
- Age of more than 18 years
- Both sexes.

**Exclusion Criteria**

The following criteria were excluded from the study:

- Age <18 years
- Compound Grades II, IIIa, IIIb, and IIIc fracture
- The patient did not fit for surgery due to comorbid conditions
- Procedure: Fracture fibula was addressed first.

**Pre-operative Assessment**

- X-ray of the affected leg including one joint above and one joint below; including the ipsilateral knee and ankle joints
- Minimum two views are necessary: Anteroposterior and lateral views
- Pre-operative nail length is measured clinically
- The diameter of the nail is measured using the pre-operative X-rays at the level of the isthmus.

**Post-operative Protocol**

- Static quadriceps and ankle pump exercises started at the end of 48 h
- Active knee range of motion (ROM) exercises were started
- EOT has done on the 3<sup>rd</sup>, 6<sup>th</sup>, and 9<sup>th</sup> post-operative days
- Suture removal was done on the 11<sup>th</sup> post-operative day
- Full ROM of knee at discharge on the 12<sup>th</sup> post-operative day

- Non-weight-bearing for 6 weeks; the first visit after 6 weeks
- Partial weight-bearing started after evidence of callus formation (6 weeks–3 months) and
- Full weight-bearing started when there is the radiological union of three cortices.

Postoperatively, patients were followed up clinically and radiologically at 6 weeks, 3 months, 6 months, and 1 year and then yearly intervals until the fracture heals completely.

Orthopedic trauma association classification was used at the time of admission and fractures were classified according to it. The nature of the injury was also noted.

Post-operative radiographs were taken to assess the tibial malalignment. The degree of the tibial angulation (varus or valgus), (anteroposterior), and (rotational) and shortening were evaluated radiologically and clinically.

At the end of 1 year, the range of movement (dorsiflexion and plantar flexion) at the ankle was determined. The functional assessment of ankle function is done by “Ankle evaluation rating system” by Merchant and Deitz. “Johner and Wruch’s Criteria” were used for final evaluation.

**RESULTS**

Among the 15 patients who studied, 12 were male; the highest number of patients was seen in 20–40 years (53.3%) age group. The average was 37.2 years. Most cases were due to road traffic accidents (73.3%). The other mechanisms being accidental fall from height (26.6%) [Table 1]. In this study, 80% of cases were closed fractures and 20% were open fractures of the tibia. In open fractures, three were of compound Grade I (20%) according to Gustilo and Anderson’s classification.

In this study among 15 patients, 9 patients did not have any angulation, 6 patients had varus angulation with mean varus of 2°, and none of the patients had valgus angulation. None of the patients had anteroposterior angulation. None of the patients had rotational malalignment and shortening. The mean range of movements in patients with fibula fixation

**Table 1: Classification (OTA classification)**

Classification	Frequency	Percentage
A1	2	13.3
A2	4	26.6
A3	5	33.3
B2	2	13.4
B3	2	13.4
Total	15	100

OTA: Orthopedic Trauma Association

was 96%. Among the 15 patients, 11 patients (73.3) had excellent results and 4 patients (26.7) had a good result, with no fair and poor results [Table 2]. Ankle evaluation rating system score showed 66.4% of patients got 100 points [Table 3]. Meantime of union in these patients was 5 months (minimum of 4 months and a maximum of 7 months) [Table 4 and Figures 1 and 2].

One of 15 patients had wound complications at the fibular tens nail incision site. It was a superficial infection which was treated with intravenous antibiotics.

Among the 15 patients, 12 patients (80%) had an excellent result and 3 (20%) had good results. There were no fair and poor results in Johner and Wruch's criteria [Table 5].

**DISCUSSION**

In the fractures of both bones of leg involving the distal third region, the importance of fixing of fibular fracture has not yet been clearly analyzed. This study was conducted in 15 patients to analyze the results of fixing the fibula fracture in fractures of the lower third of the shaft of tibia

**Table 2: Ankle range of motion**

Range of motion	Frequency	Percentage
Excellent (100%)	11	73.3
Good (75–100%)	4	26.7
Fair (50–75%)	-	-
Poor (<50%)	-	-
Total	15	100

**Table 3: Pattern of clinical AERS score**

Ankle evaluation score (total 100 points)	Frequency	Percentage
<60	-	-
60–80	1	13.3
>80	5	33.3
100	9	66.4
Total	15	100

AERS: Ankle evaluation rating system

**Table 4: Pattern of time of union**

Time of union (in months)	Frequency	Percentage
≤5	10	66.6
>5	5	33.3
Total	15	100



**Figure 1: (a) Pre-operative anteroposterior (AP) view, (b) pre-operative lateral view, (c) 2 weeks AP view, (d) 2 weeks lateral view, (e) 1-year follow-up AP view, (f) 1-year follow-up lateral view**



**Figure 2: (a) Range of motion (ROM) – dorsiflexion (0–20°), (b) thigh foot axis (7°), (c) ROM – plantar flexion (0–45°), (d) no varus/valgus malalignment (Johner and Wruch's criteria: Excellent)**

**Table 5: Johner and Wruch's criteria**

Type	Excellent (number of PTS)	Good (number of PTS)	Fair (number of PTS)	Poor (number of PTS)
Non-union	None (15)	None (nil)	None (nil)	Yes (nil)
Deformity (varus/valgus)	None (12)	2–5° (3)	6–10° (nil)	>10° (nil)
Mobility at ankle (%)	Normal (12)	>75% (3)	50–75% (nil)	<50% (nil)
Gait	Normal (15)	Normal (nil)	Insignificant limp (nil)	Significant limp (nil)

and fibula. In all of the cases, the fractured tibia was treated with interlocking intramedullary nailing.

In 12 of 15 patients, there was a mild amount of valgus/varus angulation at the fracture site within the acceptable range. The average valgus angulation was 2.8° and average varus angulation was 4.3°. Only one patient had a varus angulation of 8°. In comparison to the previous studies, where fibula was treated conservatively in fractures of distal third of tibia and fibula, the valgus and varus angulation in our study were significantly less. Acceptable angulation was 5°.

Fibular plate fixation increased the initial rotational stability after distal tibial fracture compared with that provided by tibial intramedullary nailing alone. However, there was no difference in rotational structural stiffness between the specimens treated with and without plate fixation as applied torque was increased.

Comparing the results of this study with the above-mentioned literature, when the fixation of fibula<sup>[12]</sup> is done before nailing of tibia, it helps in alignment of the proximal and distal tibial fragments and maintains the length of lateral column,<sup>[13]</sup> thereby reducing the incidence of varus/valgus malalignment at the fracture site.

Merchant and Deitz<sup>[5]</sup> in their clinical study of 3717 patients followed up for 29 years had a mean ankle evaluation score of 88.4 points for patients with a distal third of the shaft of the tibia. All of the patients in their series were treated non-operatively with a cast.

In our study, the less mean score when compared to the study by Merchant and Deitz may be accounted to the shorter duration of the follow-up (the longest duration of follow-up being 1 year, 6 months with a mean duration of 11.3 months).<sup>[5]</sup>

One of 15 patients treated with fixation of fibula developed superficial wound infections over the fibular incision site. It was controlled by appropriate dressing and antibiotics.

The average union time was 5 months; a minimum of 4 months and a maximum of 6 months. There were no non-unions. Comparing our results with the previous studies conducted by Richmond *et al.*,<sup>[14]</sup> in 2004, the time

of union was not influenced by the fixation of fibula. All fractures united within the acceptable duration for union.

The final analysis of results according to Johner and Wruch's criteria showed excellent to good outcomes in most of the patients (12 patients, 80%) and favorable in 3 (20%) of the patients.

## CONCLUSION

Treatment of distal third both bone leg fractures by fixation of fibula by closed tens nailing in addition to the tibia is useful in anatomical reduction of tibia and reduced malalignment of tibia with good ankle functions. Further randomized control studies are needed to assess the long-term functional outcome in these patients.

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