

Original Research Article

Functional outcome of internal fixation of distal third shaft of fibula by tens nailing in addition to tibia in both bone leg fractures

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ABSTRACT

Background: The distal tibia and fibula fracture are common orthopaedic injuries resulting from high-energy trauma such as falls, sports-related incidents, and motor vehicle accidents. The optimal fixation strategy for these fractures remains a subject of debate. Traditional methods, such as plating and screw fixation, provide stability but may be associated with complications, including soft tissue compromise and delayed healing. In recent years, elastic nailing has emerged as a minimally invasive surgery alternative for fibular fixation, particularly when performed in conjunction with distal tibial fractures. The study was done to evaluate the functional outcomes of fibular fracture fixation using elastic nails in combination with distal tibial fractures. Key outcome measures include pain levels, range of motion, return to daily activities, and complication rates.

Methods: A prospective cohort of 20 patients with distal tibia-fibula fractures underwent surgical fixation with elastic nails was assessed. Clinical and functional outcomes was evaluated using standardized scoring systems, radiographic assessments, and patient-reported measures at regular follow-up intervals.

Results: Preliminary findings suggest that elastic nailing provides adequate stabilization while minimizing soft tissue disruption. Patients demonstrated satisfactory functional recovery with acceptable pain levels and early mobilization. Complication rates, including non-union and implant-related issues, were comparable to or lower than those associated with conventional fixation methods.

Conclusions: Elastic nailing for fibular fractures, when used in conjunction with distal tibial fracture fixation, appears to be a viable and effective treatment option for bone healing.

Keywords: Functional outcome, Distal tibia and fibula, Tens nailing

INTRODUCTION

Diaphyseal fractures of the tibial fibula are among the most common long bone fractures.^{1,2} Around the distal third area of tibia fibula, it contributes about 20–30% of total fracture.^{1,3} There is a risk of malunions, ankle stiffness from extended immobilization, delayed union, and tibial malalignment in either valgus or varus when the leg is treated non operative. Elastic nails provide a less invasive

alternative to screws and plates for managing distal fibula fractures. Fibular fractures in 77.7% of the cases are common with tibial fractures. Fibula fixation as an additive method was proposed by Morrison et al to manage the fractures of the tibia and fibula. In both clinical and laboratory settings the role of fibular fracture fixation in cases of distal tibia fibula fractures has been examined, and particularly in the setting of distal tibia fractures, has been shown to help maintaining the tibia fracture reduction.

Previously, studies have reported that effective plating of the fibula fracture improves alignment and the ability of the tibial fracture fixation to resist motion across the defect and prevents loss of reduction.⁴ Schoot et al followed 88 patients with distal third leg fractures to evaluate angular deformity, osteoarthritis of the knee and ankle, and other residual symptoms.⁵ They found a positive association between tibial malalignment and degenerative changes in the knee and ankle joints. Based on these findings, they emphasized that distal third tibial fractures should be managed carefully to minimize angular deformity and reduce the risk of late arthritis.

Intramedullary interlocking nailing is considered a best treatment option because it is associated with lower rates wound complications, fewer malunion, and immediate early weight-bearing and mobilization. Malalignment of the tibia can cause irregular distribution of articular pressures in the knee and ankle, which may predispose to early osteoarthritis. Therefore, this study was undertaken to evaluate the clinical relevance and benefits of fibular fixation using closed TENS nailing in addition to tibial fixation in distal third fractures of both bones of the leg.

The aim of this study is to analyze and evaluate the functional outcome of internal fixation of the distal third shaft of the fibula using TENS (Titanium Elastic Nailing System) in addition to tibial fixation in fractures involving both bones of the leg. The objectives are to assess tibial malalignment in patients with distal third fractures of both bones of the leg treated with closed TENS nailing of the fibula along with tibial fixation; evaluate the range of motion of the ankle joint following fracture fixation; determine the overall functional outcome after surgical management of these fractures.

METHODS

Source of data

The study was conducted on patients with distal both bone leg fractures for whom fibular fixation is done by TENS nailing followed by tibial fixation in Karnataka institute of medical sciences, Hubli from March 2024 to September 2025 with minimum of 6months follow up. This prospective study, conducted at Karnataka Medical College Research Institute from March 2024 to September 2025, included a sample of 20 patients.

Inclusion criteria

Inclusion criteria involve closed third both bone leg fracture, open (Gustilo Andersons) type 1 and 2 and age of the patient more than 18 years.

Exclusion criteria

Exclusion criteria involve age less than 18 years, intraarticular fracture and open (Gustilo- Andersons) type 3a, 3b and 3c fractures.

Sample size estimation

According to hospital statistics from the previous year, the prevalence of distal fibula fracture was 5 %. Considering a 95% confidence interval and 10% allowable error, the calculated sample size using the formula $n = 4pq/L^2$ was 19.44 which was rounded off to 20 cases.

Statistical analysis

Data were analyzed using IBM SPSS Statistics (version 25.0). Continuous variables such as range of motion, and time to union were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. Changes in functional outcomes (functional scores) across follow-up intervals were analyzed using repeated measures ANOVA. In cases where data were not normally distributed, the Friedman test was applied. Association between categorical variables was assessed using chi-square test or Fisher's exact test. A $p < 0.05$ was considered statistically significant.

Methodology

Informed consent will be taken before start of the study. Demographic data will be obtained from case records. The study was approved by the institutional ethical committee clearance

Pre-operative assessment

Thorough History taking and Clinical Examination will be carried out on all admitted patients from orthopedic OPD/emergency trauma ward. Anterior-Posterior view and Lateral view will be taken of the 6 ipsilateral leg one joint above and one joint below. Preoperative nail length is measured clinically diameter is measured using pre operative x rays at the level of isthmus. Patients will be taken up for the study based on Inclusion and exclusion criteria. Fractures will be classified as per OTA/AO classification.

Procedure

The fibular fracture was addressed first during the surgical procedure.

Fibular fixation technique is a closed reduction and internal fixation with TENS nailing. A small incision was made just below the tip of the lateral malleolus. An awl was then used to create an entry point at the anterolateral aspect of the distal fibula. Following this, a 2.5–3.0 mm titanium elastic nail (TENS) was inserted through the opening. Under C-arm fluoroscopic guidance, the nail was advanced from the distal fragment toward the proximal fragment to achieve fixation of the fibular fracture.

Technique of intramedullary nailing of tibia where all cases were operated under spinal anesthesia.⁶ The patient

was positioned supine on a radiolucent table. A radiolucent triangle bolster was used under the knee to maintain the position of hip in flexion of 70-90 degree and knee flexion of 60- 90 degree. The fractured leg was painted and draped. A small incision 3cm is made at midline from inferior pole of patella to tibial tuberosity. A patellar tendon splitting approach was undertaken. A curved awl is used to open medullary canal. A guide wire was inserted into the medullary canal then closed reduction done under the C arm guidance guide wire passed into distal fragment. A cannulated reamer was used for serial reaming. Then the nail of appropriate size was inserted into guide wire into medullary canal then reduction done. Then proximal and distal locking was done using locking bolts

Postoperatively, Limb elevation will be given and Knee bending exercises are started on post op day 1. Dressing will be done on post operative day 2 and 5. Walker based non weight bearing mobilization will be started on day 2 till 4-6 weeks followed by partial weight bearing for 1 month.

The patients will be assessed clinically, functionally at follow up of 6 weeks, 6 months and 1 year. Radiologically, the fracture will be designated as united when there will be periosteal bridging callus at a fracture site at least in 3 cortices in AP and Lateral views. Finalized by Johner Wruh's criteria.

RESULTS

A total of 20 patients with fractures of the distal third of the tibia and fibula were included in this study. All patients were treated with closed TENS nailing of the fibula followed by intramedullary nailing of the tibia at Karnataka Institute of Medical Sciences, Hubli, between March 2024 and September 2025. Each patient was followed up for a minimum period of six months. The age of the patients ranged from 21 to 72 years, with a mean age of 44.5 years.

Regarding the mode of injury, the majority of cases resulted from road traffic accidents (60%), while the remaining cases were due to accidental falls from height (40%). In terms of the side of involvement, the left leg was more commonly affected, observed in 11 patients, whereas the right leg was involved in 9 patients.

Type of fracture (open or closed)

In this study, 55% of the fractures were closed, while 45% were open fractures of the tibia. All open fractures were classified as Grade I compound fractures according to the Gustilo-Anderson classification.

Assessment of radiological valgus/varus angulation

In this study of 20 patients, 13 patients showed no angular deformity on radiological assessment. Five patients demonstrated varus angulation, with a mean varus

deformity of approximately 2°, while one patient had valgus angulation measuring 4°. Based on the degree and type of angulation, the patients were categorized into four groups. Poor: >10-degree valgus / varus; Fair: 6–10-degree valgus / varus; Good: 2–5-degree valgus / varus; Excellent: 0 -1-degree valgus/ varus.

Antero-posterior malalignment: 3 of the patients had antero-posterior angulation all had posterior angulation. Rotational malalignment and Shortening: None of the patients had rotational malalignment and shortening.

Range of movements at the ankle (expressed as a percentage)

The mean range of movements in patients with fibula fixation was 96%. To assess the range of movements at the ankle, the patients were divided in to 4 groups; Excellent: 100% motion of ankle; Good: >75% motion of ankle; Fair: 50 – 75% motion of ankle; Poor: <50% motion of ankle.

Among the 20 patients; 15 patients (75%) had excellent results, 5 Patients (25%) had good result with no fair & poor results.

Ankle evaluation

Assessment of ankle function according to the criteria of Merchant and Dietz score was observed at the end of 1year follow up. It is a 100-point scale allotting 40 points for function, 40 for pain, and 10 for gait and 10 points for range of motion at the ankle. The mean clinical score was 91.9.

Mean clinical time of union

The average time for fracture union in these patients was 7.2 months, with a minimum duration of 6 months and a maximum of 9 months.

Complications

Only one out of the 20 patients developed a wound complication at the fibular TENS nail incision site. This was a superficial infection, which was successfully managed with intravenous antibiotics. Regarding angular deformity, five patients showed varus angulation with a mean varus deformity of about 2°, while one patient demonstrated valgus angulation measuring 4°.

Table 1: Age wise distribution.

Age in years	Frequency	Percentage (%)
<20	1	5
20-39	7	35
40-59	8	40
>60	4	20
Total	20	100
Mean age		44.5±17.12 year

Table 2: Sex wise distribution.

Sex	Frequency	Percentage (%)
Male	12	60
Female	8	40
Total	20	100

Table 3: Side wise distribution.

Side	Frequency	Percentage (%)
Left	11	55
Right	9	45
Total	20	100

Table 4: Type of fracture based on Gustilo Anderson classification.

Type of fractures	Frequency	Percentage (%)
Closed fracture	11	55
Open fracture (Type 1)	9	45
Total	20	100

Table 5: Radiological assessment of varus/ valgus angulation.

Valgus/Varus (in degrees)	Frequency	Percentage (%)
Excellent (0-1)	13	65
Good (2-5)	7	35
Fair (6-10)	0	0
Total	20	100

Table 6: Johner and Wruch's criteria.

Results	Frequency	Percentage (%)
Excellent	13	65
Good	6	30
Fair	1	5
Poor	-	0
Total	20	100

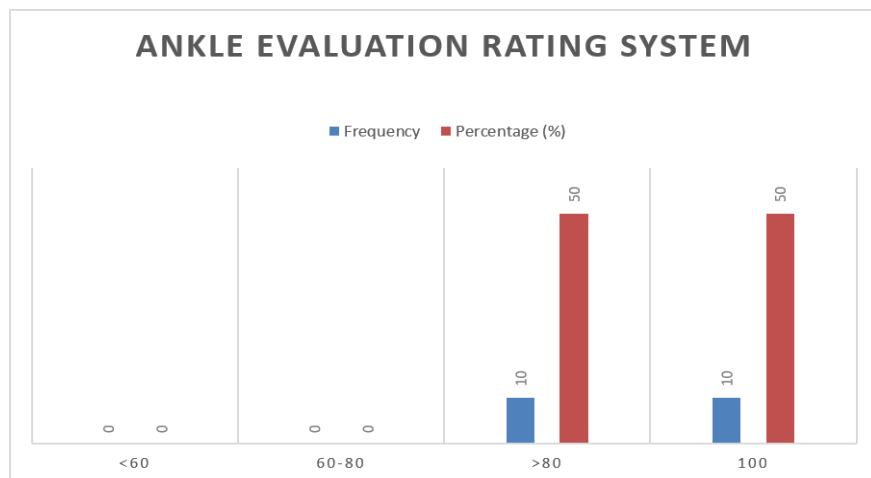


Figure 1: Ankle evaluation rating system.

DISCUSSION

Although fibular fixation is commonly performed, its exact role in distal third fractures involving both bones of the leg has not been clearly established. Therefore, this study was conducted on 20 patients to evaluate the outcomes of fibular fixation in fractures of the distal third of the tibia and fibula.

In all cases, the tibia fracture was managed with interlocking intramedullary nailing, while the fibula was fixed as part of the treatment protocol. On radiological assessment, 13 patients showed no angular deformity, 5 patients demonstrated varus angulation with a mean deformity of 2°, and 1 patient had valgus angulation measuring 4°.

Following are the literature support; Journal of Orthopaedic Trauma of February 2006 - Volume 20 - Issue 2 - pp94-103; it was proposed that, the proportion of fractures that lost alignment was very minimal among those receiving stabilization for fibula fracture in conjunction with IM nailing in comparison with those candidates receiving IM nailing alone. The authors insisted on fibular fixation whenever IM nailing is contemplated in the unstable distal tibia fibular fracture.⁷

Fibula fixation and intramedullary nailing of distal tibial fibular fractures is a valid technique which prevents malalignment and respects soft tissue envelope.⁸

In laboratory simulation, fibular fixation initially increased stability by decreasing initial rotational displacement in nailed distal third tibial fractures. These data support our clinical observations that fibular fixation may decrease late valgus malalignment in distal third comminuted tibia fractures with a fibular fracture at the same level.⁹

A study reported that plate fixation of the fibula improved the initial rotational stability in distal tibial fractures compared with tibial intramedullary nailing alone. However, as the applied rotational torque increased, no significant difference in overall rotational structural stiffness was observed between specimens treated with fibular plate fixation and those without it.¹⁰

When these findings are considered alongside other studies, it suggests that fixing the fibula before intramedullary nailing of the tibia can aid in proper alignment of the proximal and distal tibial fragments. Additionally, fibular fixation helps maintain the length of the lateral column of the leg, thereby reducing the likelihood of varus or valgus malalignment at the fracture site.

Merchant et al conducted a long-term clinical study involving 3717 patients, with a 29-year follow-up, and reported a mean ankle evaluation score of 88.4 points in patients with fractures of the distal third of the tibial shaft.

In their series, all patients were treated non-operatively using cast immobilization.¹¹

In comparison, the mean ankle evaluation score in our study was 91.92 points. The slightly higher score may be attributed to the shorter duration of follow-up in our study, where the maximum follow-up period was 1 year and 6 months with a mean duration of 11.3 months.

Among the 20 patients treated with fibular fixation, one patient developed a superficial wound infection at the fibular incision site, which was successfully managed with appropriate dressings and antibiotic therapy.

The average time to fracture union was 5 months, ranging from 4 to 6 months, and no cases of non-union were observed. When compared with the study conducted by Jeffrey et al the time to union was not significantly affected by fibular fixation, and all fractures in our study healed within the expected period.¹² According to the Johner and Wruh's criteria, the final outcome was excellent in 13 patients (65%) and good in 7 patients (35%).

CONCLUSION

Fixation of the fibula in distal third fractures of both bones of the leg, when performed along with tibial intramedullary nailing, is associated with lower rates of tibial malalignment and better maintenance of limb length, helps restore the height of the lateral column, facilitating anatomical reduction of the tibia and thereby reducing the incidence of varus and valgus malalignment. It promotes better healing of the soft tissues and syndesmotic structures, resulting in improved functional outcome while also reducing surgical soft-tissue trauma.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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