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THE OUTCOME OF OPERATIVE MANAGEMENT OF FRACTURE TIBIA AND FIBULA WITH VS WITHOUT STABILISATION OF FIBULA – A COMPARATIVE STUDY

Orthopaedics

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ABSTRACT

Fractures of the of the tibia are mostly associated with a fibular fracture that often requires fixation. The preferred treatment of tibial fracture is theintramedullary nailing or plating procedure. However, no clear cut guidelines are there on fixation of associated fibular fractures. Fixation of fibula results in better alignment anatomically and better control over rotation while also introducing stability and restoring limb strength.Adding to it, it has been reported that there are significantly higher rates of loss of reduction in distal tibia fractures treated with an IM nail without plate stabilisation of the combined fibula fracture. Moreover, after fibula fixation the bio-mechanical structure is considered to be more similar to that present before the injury.Conversely, the opposing view is that fibular fixation may result in delayed union or nonunion because it inhibits cyclic loading on the tibial fracture site . Meanwhile, high-energy fractures of the distal tibia are often accompanied with a high incidence of soft tissue trauma leading to a high incidence of wound infections and necrosis [20] Consequently, the open reduction and internal fixation of the fibula required often increases the rate of wound complications.Presently, there is no clear consensus on the optimum management of combined distal third tibia and fibula fractures. Our aim is to assess whether combined distal third tibia and fibula fractures will benefit from concurrent fibular fixation.

KEYWORDS

INTRODUCTION

Tibial fractures are among the most common long-bone injuries, particularly in high- and low-energy trauma. Owing to its subcutaneous anteromedial location and limited soft-tissue coverage, the tibia is highly vulnerable. Shaft and distal fractures frequently coexist with fibular fractures. Although the tibia bears most axial load, the fibula contributes 6–17% of load transmission and provides lateral column stability, rotational control, and ankle mortise congruency, especially in distal-third injuries.

Intramedullary nailing is standard for diaphyseal fractures, while MIPO plating is preferred for metaphyseal and distal fractures. However, distal tibial fractures remain prone to malalignment and soft-tissue complications.

The role of fibular fixation is controversial. It may improve alignment and construct stability, particularly in distal fractures, but can increase soft-tissue morbidity and potentially impair tibial micromotion and healing. Management requires balancing biomechanical advantages against biological and soft-tissue risks.

METHODS AND METHODOLOGY

This ambidirectional cohort study evaluates outcomes of operative fixation of combined tibia–fibula fractures with versus without fibular stabilization. It will be conducted in the Department of Orthopaedics, Vivekananda Institute of Medical Sciences (VIMS), Ramakrishna Mission Seva Pratishthan, Kolkata, from June 2018 to June 2025, including recruitment, surgery, and follow-up.

A total of 101 patients (Cochran's formula: p=0.88, e=2%, 95% CI) will be enrolled by consecutive sampling. Adults (≥18 years) with acute tibial fractures and associated fibular fracture (closed or Gustilo–Anderson Grade I) fit for surgery and consenting will be included. Exclusion criteria comprise bimalleolar/pilon fractures, isolated fibular fractures, neurovascular injury, old fractures, open fractures ≥Grade II, polytrauma with poor GCS, age <18 years, and unfit patients.

Patients will be divided into:
Group A: Tibial fixation with adjunctive fibular plating.
Group B: Tibial fixation without fibular stabilization.

The decision for fibular fixation will be intraoperative and surgeon-dependent.

Preoperative assessment includes clinical evaluation, radiographs (knee and ankle), and routine laboratory investigations. Tibial fractures will be managed with intramedullary interlocking nailing or plate osteosynthesis. Standard antibiotic prophylaxis and rehabilitation protocols will be followed.

Follow-up will occur at 6 weeks, 3 months, and 6 months with clinical and radiological assessment.

Outcomes:
Radiological—time to union, non-union at 6 months, coronal/sagittal deformity, rotational malalignment.

Clinical—range of motion, weight-bearing status, functional recovery. Complications—infection, wound issues, implant failure, delayed/non-union.

Data will be recorded in a structured proforma and analyzed using SPSS/STATA/R with descriptive statistics.

RESULTS

This comparative study included 101 patients with tibial fractures associated with fibular fractures, divided into Group A (n = 51; tibial fixation with fibular stabilisation) and Group B (n = 50; tibial fixation without fibular stabilisation).

The majority of patients were young to middle-aged adults, with 84.2% between 18 and 50 years. Group A patients were significantly younger than Group B (35.86 ± 12.29 vs 41.64 ± 13.05 years; p = 0.024). There was a marked male predominance (74.3%), with comparable sex distribution between groups. Right-sided injuries were slightly more common (56.4%). Road traffic accidents were the most frequent mechanism of injury (60.4%), followed by falls from height.

Most fractures were closed injuries (83.2%); all open fractures were Gustilo–Anderson Grade I. According to AO/OTA classification, 43-A2 fractures were most common (51.5%), followed by 43-A1 and 43-A3, with similar fracture patterns in both groups. The distal third of the tibia was the most commonly involved segment (65.3%), and most fibular fractures occurred at the same level.

Comorbidities such as diabetes, smoking, and hypertension were evenly distributed between groups without statistical significance. Mean time to surgery was comparable between groups. Intramedullary interlocking nailing was the most common tibial fixation method (77.2%). In Group A, fibular fixation was performed using one-third tubular plates (68.6%) or locking compression plates (31.4%).

Mean time to radiological union was similar in both groups (p = 0.769). However, Group A demonstrated significantly better coronal plane alignment (p = 0.006) and lower rotational malalignment (p = 0.0003). Sagittal plane alignment showed a trend toward improvement but was not statistically significant. Functional outcomes (AOFAS score) favored Group A but did not reach significance, and VAS pain scores were comparable. Complication rates, including infection, delayed union, non-union, and re-operation, were similar between groups.

DISCUSSION

Demographic and Injury Profile

The cohort showed male predominance (74.3%), largely within the 18–50-year working population, consistent with global trauma epidemiology where high-energy mechanisms—particularly road traffic accidents (60.4%)—predominate in males. Although the non-fibula fixation group had a significantly higher mean age, both groups comprised skeletally mature adults with comparable fracture patterns, minimizing age as a major confounder. While advanced age may affect biological healing, alignment outcomes are primarily determined by mechanical stability and fracture configuration rather than chronological age alone.

Fracture Pattern and Baseline Homogeneity

Most injuries were extra-articular distal tibial fractures (AO/OTA 43-A), predominantly 43-A2. Comparable fracture distribution between groups ensured baseline homogeneity, strengthening internal validity. Distal third tibial fractures with concomitant distal fibular fractures are biomechanically prone to malalignment due to metaphyseal flare, reduced cortical contact, and diminished nail purchase, providing the theoretical rationale for adjunctive fibular stabilization.

Radiological Alignment

Coronal Plane (Varus–Valgus)

Fibular fixation significantly improved coronal alignment. Patients with fibular plating demonstrated lower varus–valgus deformity, supporting the concept of the fibula as a lateral strut resisting coronal collapse. Prior biomechanical and clinical studies similarly report increased valgus malalignment when the fibula is left unfixed, particularly with intramedullary nailing. These findings reinforce fibular stabilization as an effective adjunct for coronal plane control in distal tibial fractures.

Sagittal Plane (Procurvatum/Recurvatum)

Sagittal alignment was better in the fixation group but not statistically significant. Sagittal control appears more dependent on reduction technique, entry point accuracy, and distal locking configuration of tibial implants rather than fibular status alone. This aligns with prior reports indicating inconsistent influence of fibular fixation on sagittal deformity.

Rotational Stability

A key finding was the highly significant reduction in rotational malalignment with fibular fixation. Rotational deformity, often clinically under-recognized, has substantial functional implications. Biomechanical evidence demonstrates increased torsional stiffness with fibular stabilization, and clinical studies report reduced rotational malalignment when the fibula is fixed. The present data provide strong clinical support for improved rotational control with fibular plating.

Fracture Union

Despite superior alignment, time to union and union rates were comparable between groups. This supports existing literature indicating that fibular fixation enhances mechanical stability without necessarily accelerating biological healing. Concerns regarding stress shielding and delayed union remain theoretical and inconsistently supported clinically. The absence of non-union in the fixation group, though not statistically significant, is clinically relevant.

Functional Outcomes

AOFAS scores were higher in the fibular fixation group but did not reach statistical significance. Improved radiological alignment may not translate into early measurable functional gains, particularly within 6 months. However, persistent coronal or rotational malalignment is associated with long-term ankle degeneration, suggesting potential delayed functional advantages.

Complications and Comorbidities

Complication rates—including infection, delayed union, and reoperation—were comparable. Fibular fixation did not significantly increase wound complications, likely reflecting careful selection and minimally invasive techniques. Diabetes and smoking were similarly distributed, minimizing confounding effects.

Clinical Implications

Fibular fixation should not be routine but selectively applied, particularly in extra-articular distal third tibial fractures with same-level fibular fractures. It provides significant coronal and rotational stability without increasing complications or impairing union, offering meaningful mechanical advantages in alignment-sensitive fracture patterns.

RESULTS

Fractures of the tibia are among the most common long bone injuries encountered in orthopaedic practice and are frequently associated with concomitant fibular fractures, particularly in the distal third of the leg. While operative fixation of tibial fractures has become the standard of care, the role of adjunctive fibular stabilisation remains controversial. Although biomechanical studies suggest that fibular fixation improves construct stability and alignment, clinical evidence regarding its effect on fracture union, functional outcome, and complications remains inconclusive. The present study was undertaken to evaluate and compare the clinical, radiological, and functional outcomes of operatively managed tibia-fibula fractures treated with and without fibular stabilisation.

This ambidirectional cohort study included 101 adult patients with fractures of the tibia associated with fibular fractures treated surgically at a tertiary care centre. Patients were divided into two groups: Group A (n = 51) underwent tibial fixation with adjunctive fibular stabilisation, while Group B (n = 50) underwent tibial fixation without fibular stabilisation. Patients were followed up at regular intervals up to six months, and outcomes were assessed in terms of fracture union, radiological alignment, functional outcome, and complications.

The study population predominantly comprised young and middle-aged males, with road traffic accidents being the most common mechanism of injury. Distal third extra-articular tibial fractures (AO/OTA 43-A) constituted the majority of cases, and fracture patterns were comparable between the two groups, ensuring baseline homogeneity. Most patients were treated with intramedullary interlocking nailing, with a smaller proportion undergoing minimally invasive plate osteosynthesis.

Radiological analysis demonstrated that patients who underwent fibular fixation had significantly better coronal (varus-valgus) alignment and rotational alignment compared to those without fibular stabilisation. Although sagittal plane alignment was better in the fibula fixation group, the difference was not statistically significant. The mean time to fracture union and overall union rates were comparable between the two groups, indicating that fibular fixation did not significantly influence fracture healing duration. Delayed union and non-union rates were slightly higher in the non-fibula fixation group; however, these differences were not statistically significant.

Functional assessment using the AOFAS score revealed higher mean scores in the fibula fixation group, though the difference did not reach statistical significance at six months. Pain scores were comparable between the two groups. The incidence of complications, including infection, delayed union, non-union, and need for re-operation, was similar in both groups, and fibular fixation did not result in a statistically significant increase in soft tissue or wound-related complications.

In conclusion, the present study demonstrates that adjunctive fibular stabilisation provides significant advantages in maintaining coronal and rotational alignment in operatively managed tibial fractures, particularly in distal third extra-articular fractures. However, fibular fixation does not significantly influence fracture union time, union rates, or short-term functional outcomes.

Based on these findings, fibular stabilisation should be considered selectively rather than routinely, especially in fracture patterns where alignment control is critical. The study contributes valuable clinical evidence toward rational, pattern-based decision-making in the management of tibia-fibula fractures.

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