Section: Physiotherapy

Original Research Article

ASSESSMENT OF PATIENTS WITH EXTRA-ARTICULAR DISTAL TIBIA FRACTURES TREATED BY INTRAMEDULLARY NAILING

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ABSTRACT

Background: Distal tibia fractures involving the tibial metaphysis frequently present considerable challenges for orthopaedic surgeons. The limited vascularity, subcutaneous positioning, and proximity to the hinge-configured ankle joint, which plays a crucial role in weight transmission and complex biomechanics, contribute to a high incidence of complications. **Materials and Methods:** A prospective follow-up was conducted on 60 patients who sustained distal tibia fractures and were treated with intramedullary nailing. This study focused on patients with extra-articular distal tibia fractures during the period from March 2025 to October 2025 at the MGM College, Warangal. Upon follow-up, patients underwent clinical assessments at the conclusion of 3, 6, and 9 months. Functional scores, such as the American Orthopaedic Foot and Ankle Society Score and the Olerud and Molander Scores, were determined using relevant patient questionnaires. Functional scores were analysed using STATA 14.0 software for statistical evaluation. **Result:** Among the 60 patients recruited for the study, 45 were male, and 15 were female. 75% (n=45) experienced the injury as a result of high-velocity impact. The mean duration to surgery was 4.18 days. The average duration required for partial weight bearing was 12 weeks. The average AOFAS score in males was 80.25 at three months post-surgery and 88.74 when assessed six months after the procedure. The average Olerud and Molander score was 78 at three months and 80 at six months post-surgery. **Conclusions:** Intramedullary nailing resulted in reliable union and favourable functional outcomes in patients with distal tibia fractures. The AOFAS score and the Olerud and Molander score are effective scoring systems for evaluating the functional outcomes in patients with distal tibia fractures. There is a notable occurrence of implant-related pain in patients who have undergone IM nailing.

INTRODUCTION

The swift expansion of urbanization and advancements in technology have resulted in a significant rise in the network of roads and the volume of vehicles operating on them. There has been a notable increase in the number of road accidents. The World Health Organization estimates that there are approximately 1.3 million fatalities annually as a result of road traffic accidents. An estimated 20 to 50 million individuals experience non-fatal injuries due to road traffic accidents, with many leading to considerable disability.[1]

The majority of RTA fatalities in India involve vulnerable road users, such as pedestrians and two-wheelers. Road traffic accidents in India are frequently caused by reasons such as speeding, alcohol use, seat belt and helmet evasion, lack of child restraint seats, limited visibility, inattentive driving, and dangerous roads.[2] India has a 14% road traffic accident fatality rate, which is alarmingly high compared to China's 5% rate.

Long bones, particularly tibia, are vulnerable during RTA due to their subcutaneous position. Tibial shaft fractures, the most common long bone fracture, affect 4% of seniors.

The bimodal pattern of tibial fractures involves both low and high energy pathways. Torsional forces and indirect trauma cause low-energy injuries, such as spiral fractures.

A fibular fracture at a different level with minimal soft tissue injury.[3,4] Treating distal tibial fractures with or without articular surface involvement is complex and can lead to problems such infection, malunion, non-union, and post-traumatic arthritis.[5] To achieve a successful union and recovery to pre-injury levels, selecting an appropriate implant for these fractures might be challenging.

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Closed IM nailing procedures preserve soft tissue and blood flow, resulting in abundant callus development.[6] Kempf and Klemm et al.'s creation of closed-locked IM nailing, based on the Kuntschner 'Detensor' nail, was a substantial advancement.[6] This method combines closed nailing with percutaneous screw insertion to interlock bone and nail. This enables static locking for fracture fragment rotation and telescoping, which transitions to dynamic locking during weightbearing.[6,7]

The study seeks to evaluate the functional outcomes of patients who have undergone treatment for extra-articular distal tibia fractures through Intramedullary Nailing. The focus is on individuals aged 18 to 60 years who attended the orthopaedics department at our college in Hyderabad from March 1, 2025, to October 31, 2025. Additionally, the research will investigate methods to facilitate early union and early mobilization of these patients.

MATERIALS AND METHODS

A prospective observational study was conducted at the Department of Orthopaedics, MGM Hospital, Warangal, 01/03/2025 to 31/10/2025. The study population consisted of patients with distal tibia fractures undergoing interlocking nail fixation who met the inclusion criteria. Sample size was estimated using the formula $(z\alpha)^2pq/d^2$, with a 95% confidence interval and 5% alpha error. The proportion of patients with satisfactory outcomes was set at 80%, resulting in a sample size of 60.

Inclusion Criteria: Intramedullary interlock nailing was used to treat patients aged 18-60 with open or closed distal tibia fractures (4cm-11cm above the tibial plafond/10 cm-15 cm from the mid shaft).

Exclusion Criteria: Elderly and children with fractures beyond age range, pathological fractures, metabolic bone diseases, intraarticular fractures, pelvic fractures, and polytrauma (chest wall and abdominal injuries). All patients in the study provided informed written permission. The injured limb was examined and radiographs were taken, including anteroposterior and lateral views. The regular institutional protocol was followed for patient treatment. The surgical procedures, benefits, risks, and problems were monitored at 6 weeks, 3 months, 6 months, and 9 months post-op.

Functional outcomes are assessed using AOFAS and Olerud Molander scores at 6 weeks, 3 months, 6 months, and 9 months. Each session included serial radiographs.

Data was imported into Excel and analyzed using STATA software. Patients who left the wards or were unable to complete data collection were eliminated. Statistics were analyzed using univariate and multivariate methods. An $\alpha < 0.05$ was considered significant. We employed binary and multinomial logistic regression technique to analyze survival and death rates based on the study variable. STATA 14.0 (Statistical Software: Release 14, College Station, TX: Stata Corp LP) was utilized. This software was used to determine frequencies, percentages, range, mean, standard deviation, and 'p' values. Categorical variables, such as gender, results, and cardiotoxicity, are shown as frequencies and percentages. Pie charts and bar graphs are utilized as needed. Statistical significance was determined by P-values below 0.05.

Perioperative management

Patients typically arrive in casualty and are admitted to the ward. The mode of damage and concomitant medical problems were carefully recorded. Each patient underwent a thorough clinical examination. All patients received above knee splinting to relieve pain, avoid deformity, and decrease needless movement of the fractured lower limb. Oral or parental NSAIDs were used for pain relief. Anterior-posterior radiographs of the afflicted leg were taken for all patients. Routine investigations included complete blood count, blood grouping, kidney and liver function tests, urine routine, random blood sugar, serum electrolytes, HBSAg, HIV/HCV screening, chest x-ray, and ECG. Consultation and therapy were tailored to co-morbidities like diabetes, hypertension, heart disease, COPD, liver disease, asthma, and renal failure. These individuals are well-evaluated before surgery.

The patient was apprised of the surgery's details and complications, and written informed consent was obtained. One intravenous dosage before operation. The patient received tetanus and antibody shots. Parts were prepared from umbilicus to ankle. All surgical procedures were elective and conducted under spinal or general anesthesia with aseptic precautions. Patient lies supine on radiolucent table. For entrance site access, flex the knee to 90-110 degrees and place a support under it to align the tibia and allow the foot to rest on the table. The frontal entry point aligns with the canal (mm medial of the tibial crest). The entrance site in the sagittal plane should be distal to the angle between the tibial plateau and anterior tibial metaphysis. Longitudinal skin incision over proposed entrance location. Extend it 3-5 cm from the tibial plateau. Incisions that are excessively medial hinder correct medullary canal entrance. A preliminary guide pin is used to find the entry point. Cannulated devices can be inserted over a pin. Verify the position before creating the complete opening.

To reach the distal metaphysis, pass a ball-tipped guide wire down the medullary canal after breaching the proximal metaphysis. Needs fracture reduction. Special efforts may be needed for difficult reduction or comminuted fractures. Use fluoroscopy to ensure the guide wire is positioned above the ankle joint center and penetrates through the fracture site into the distal fragment.

Nail length determination was made by a radiographic ruler.

Reaming and determination of nail diameter

Place the flexible-shaft cannulated reamer over the ball-tipped guide wire. Start with an end-cutting reamer and gradually increase the diameter, usually in increments of 0.5 mm. Entry site delicate tissues

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should be protected. The chattering feeling suggests that the reamer is in contact with the internal cortex. A millimeter or two of additional reaming usually allows for the desired diameter. The proximal medullary canal is reamed with a reamer. Exchange guide wires using a plastic medullary exchange tube. Move the medullary tube over the reaming guide wire and beyond the fracture site.

Insertion of cannulated nail

Enough reduction and over-reaming should allow for cannulated nail insertion. Make sure the nail's proximal end is submerged of the entrance site bone to reduce knee pain. Place the nail tip in the center of the distal tibia, near the physeal scar.

Locking of the nail

Use distal locking and backslap technique for distracted fractures. Recheck the nail's proximal end. Proximal locking follows.

Wound closure

Use interrupted stitches to repair the patellar tendon and paratenon. Keep loose sutures in place to seal the skin and subcutaneous tissue until the wound is fully healed. Allow knee motion with a gentle dressing.

Post operative management

Immediately after surgery, when the patient is hospitalized, focus on pain control, Mobilization, Infection and DVT prevention, Complication detection. Parenteral antibiotics were administered twice daily for three days before switching to oral antibiotics. After surgery, a check X-ray was taken. Promote active motion in all joints (hip, knee, ankle, toes). Begin gentle, gradual stretching for knee extension and ankle/foot dorsiflexion as tolerated. The patient was discharged from the hospital after suture removal on the tenth postoperative day.

Follow up

Patients were followed up at 6 weeks, 3 months, 6 months, and 9 months intervals. Functional outcome was determined using AOFAS and Olerud and Molander grading systems. Serial radiographs were taken each visit.

RESULTS

Of the 60 individuals in the trial, 45 were male and 15 were female.

The injury occurred in 75% (n=45) of the study population.

to high-energy damage. The fracture rate was 25 % (n=15) due to low energy damage. Road traffic accidents were the main source of high energy injuries.

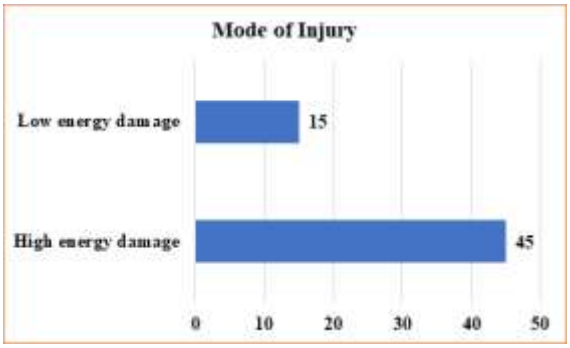

Figure 1: Mode of Injury

Low-energy fractures originate from falls below standing height, while high-energy fractures involve traumas such as falls above standing height and motor vehicle accidents [6,8]. In the research of 60 individuals, 55% (33 patients) had closed fractures. 40 % (n=24) patients experienced open injuries. All patients in the study had IM nailing for distal tibia fracture. The average time between injury and operation was 4.18 days in the study populations. Time to operation ranged from 13 to 6 days 14 hours for patients. Average time to partial weight bearing was 11.5 weeks (range: 3-19 weeks). The average time to full weight bearing was 20.4 weeks (range: 4 to 34 weeks).

The average return to work time was 30.4 weeks (range: 14-37 weeks). Two patients were unable to return to work. Of 20 patients, 4 had changed employment or not returned due to injury-related incapacity. 40 patients returned to their employment without any issues.

Table 1: Mean AOFAS score at 3 and 6 months

	3 months	6 months
Male	80.25	88.74
Female	78.6	85.24

Table 2: Mean Olerud and Molander Score at 3 and 6 months

	3 months	6 months
Male	78.1	80.5
Female	70.5	79.8

Table 3: Complications

Complications	No. of Patient's	Percentage
Malunion	1	1.6%
Non-Union	3	5%
Implant Related Pain	5	8.3%
Implant Exchange	2	3.3%

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DISCUSSION

A study of 60 individuals assessed the functional result of intramedullary nailing for extrarticular distal tibia fractures. Males predominate. (75% male, 25% female) in our study population. This is mostly due to male involvement and exposure to high-energy traumas. Our study confirms gender distribution statistics from several regions, indicating a twofold increase in frequency among males.[8] High energy injury caused 75% (n=45) of the study population to sustain injuries. Our study confirms that high energy injuries, such as road traffic accidents, are the leading cause of tibial fractures, particularly open fractures.[8,9]

15% (n=15) fractured from inadequate energy. In our study, 55% of patients had closed tibial fractures, while 40% had open injuries. While there is no published epidemiological data on the incidence of tibia fractures in our population, our data aligns with the increase in fracture type and nature.[9,10]

We found a mean time between injury and operation of 4.18 days in our research cohort. This had no substantial impact on the patient's outcome. But it's the type the fracture severity dictates the need for therapy in tibia fractures. Khatod et al. found that the Gustilo grading system for open fractures is a reliable indication of infectious complications and suggests urgent treatment for open tibia fractures to improve outcomes.[11] Charalambous et colleagues found no significant difference in infection rates or need for further treatments for bone union between early and delayed surgical treatment of open tibial fractures in 383 patients.[12] Open tibia fixation is necessary due to the danger of infection.

Our research population used conventional IM nails in all cases. Concurrent fibula fixation occurred in 30% cases. These fractures' fibula fixation role is unclear ongoing argument. There is conflicting evidence on the benefits and necessity of fibula fixation in distal tibia fractures.

Chengxin et colleagues found that additional fibular fixation reduced rotation deformity (OR=0.13; 95% CI 0.02–0.82). There was no difference in malreduction rates between the trial and control groups (OR=0.86; 95%).[13]

Numerous studies suggest that whereas fibula fracture repair may improve anatomical reduction and biomechanical forces, it may also increase non-union rates.[13,14]

The implant can help with tibial fractures by sharing weight, preserving osseous blood flow, and minimizing soft tissue dissection.[15] AOFAS Olerud/Molander scores are effective techniques for achieving functional outcomes in our study. Both scores correlated significantly.

Both measures were significantly correlated with patient functional status and had comparable values at 3- and 6-months post-surgery. Our study found 8.3% (n=5) of patients experienced implant-related pain, with 3.3% (n=2) having undergone implant exchange. The most prevalent complaint for intramedullary nailing was anterior knee discomfort. The non-union rate in IM nailing is 5 % (n=3) in our study group. Immediate post-op fracture alignment was satisfactory. No infection was found. Patient functional assessment using AOFAS, Olerud, and Molander ratings is highly correlated and helpful for distal tibia fracture patients. Results from surgical fixation scores are equivalent at selected study points.

CONCLUSION

This prospective observational study involving 60 patients with extraarticular distal tibia fractures leads to the following conclusions. A notable prevalence of males is observed within the population experiencing extraarticular distal tibia fractures. The majority of extraarticular distal tibia fractures occur due to high-energy injuries. The intramedullary nail represents a valid fixation method for distal tibia fractures and may demonstrate advantages over plating in such cases. The most prevalent consequences of intramedullary nailing for distal tibia include implant-related discomfort and non-union. The mean surgery delay does not correlate with AOFAS score at 3 months post-operation. AOFAS, Olerud, and Molander ratings are highly correlated and helpful for assessing patients' functional status after distal tibia fracture.

Conflicts of Interest: None

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