Original Article

Effect of Early Protected Weight Bearing in Fracture Shaft of Femur: A Prospective Observational Study

Siddharth Mishra[1], Rohan Pansambal[1], Rahul kadam[2]

[1]Junior Resident, Department of orthopedics, MGM medical college and hospital, Kamothe, Navi Mumbai, Maharashtra, India. [2]Professor and Head, Department of orthopedics, MGM medical college and hospital, Kamothe, Navi Mumbai, Maharashtra, India

Abstract

Background: Femoral shaft fractures in young adults commonly result from high-energy trauma. Early protected weight bearing after stable intramedullary fixation may enhance callus formation, accelerate rehabilitation, and improve functional recovery. However, concerns regarding implant failure and nonunion persist. This study evaluates radiological union, functional outcomes, and complications following early protected weight bearing. **Material and Methods:** This prospective observational study was conducted over one year at a tertiary care teaching hospital in Mumbai. Thirty-five adult patients (aged 18-60 years) with closed or Gustilo-Anderson Type I open fractures of the femoral shaft, treated with closed/reduced interlocking intramedullary nailing, were included. Early protected weight bearing (partial with walker/crutches from day 3-7 post-op, progressing to full as tolerated by 4-6 weeks) was implemented under supervised physiotherapy. Exclusion criteria included polytrauma with unstable hemodynamics, pathological fractures, and severe comorbidities. Ethical approval was obtained from the institutional review board, and informed consent was taken. Radiological assessment (union via RUST score), functional evaluation (Klaus and Borner criteria), and complications were documented at regular intervals up to 12 months. Data were analyzed using SPSS version 25 with appropriate statistical tests ($p<0.05$ significant). **Results:** Mean age was 32.4 ± 8.7 years with male predominance (82.8%). Mean time to partial weight bearing was 5.2 days and full weight bearing 5.8 weeks. Radiological union was achieved in 91.4% by 16 weeks (mean 14.8 weeks). Excellent to good functional outcomes were seen in 88.6% per Klaus and Borner criteria. Complications included 2 cases of delayed union (5.7%), 1 superficial infection, and no implant failures or malunions requiring revision. Average hospital stay was 9.4 days. Patients returned to pre-injury activity levels faster compared to historical delayed protocols. **Conclusion:** Early protected weight bearing after interlocking nailing in femoral shaft fractures appears safe and effective, leading to satisfactory union rates, good functional recovery, and minimal complications in a Mumbai tertiary setup. It supports accelerated rehabilitation without compromising stability. Larger randomized trials are recommended.

Keywords: Femoral shaft fracture, early protected weight bearing, Intramedullary nailing, Functional outcome, Radiological union.

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Introduction

Femoral shaft fractures are among the most common long bone injuries encountered in orthopedic trauma practice, particularly in busy urban centers such as Mumbai, where road traffic accidents are a major cause. These injuries are commonly associated with severe pain, blood loss, prolonged immobilization, and delayed return to daily activities. Locked intramedullary nailing has become the preferred treatment modality because it offers stable fixation and permits early mobilization with satisfactory biomechanical stability.[1,2]

Traditionally, delayed or non-weight bearing protocols were advised after surgery to reduce the risk of implant failure, malalignment, and delayed union. However, prolonged immobilization may result in quadriceps wasting, knee stiffness, thromboembolic complications, and increased hospital stay, adversely affecting functional recovery and quality of life.[3,4]

Early protected weight bearing after stable fixation may stimulate osteogenesis through controlled axial loading and micromotion at the fracture site, promoting faster rehabilitation and earlier return to function. This study aims to evaluate radiological union, functional outcomes, and complications associated with early protected weight bearing in femoral shaft fractures managed at a tertiary care center.

Materials and Methods

This prospective study was carried out in the Department of Orthopedics at a tertiary care teaching hospital in Mumbai over a period of one year. Adult patients presenting with femoral shaft fractures were managed according to ATLS protocols followed by definitive fixation. All surgeries were performed by experienced orthopedic surgeons using standard antegrade or retrograde interlocking intramedullary nailing techniques under

Address for correspondence: Dr. Rohan Pansambal, Junior Resident, Department of orthopedics, MGM medical college and hospital, Kamothe, Navi Mumbai, Maharashtra, India.
E-mail: rohanpansambal@gmail.com

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image intensifier guidance. Postoperative care emphasized multimodal analgesia, DVT prophylaxis, and supervised physiotherapy. Institutional ethical committee approval was obtained prior to commencement, and written informed consent was secured from all participants, ensuring adherence to Helsinki Declaration principles. Patient confidentiality was strictly maintained.

Inclusion criteria encompassed patients aged 18-60 years with diaphyseal femoral fractures (AO/OTA 32), including closed fractures and Gustilo Type I open fractures, amenable to closed nailing. Exclusion criteria included pathological fractures, periprosthetic fractures, polytrauma with ISS >25 or hemodynamic instability, neurological deficits affecting weight bearing, severe osteoporosis, and unwillingness to participate. This ensured a relatively homogeneous cohort focused on isolated or minimally associated injuries suitable for early rehabilitation.

Data collection involved demographic details, injury mechanism, time to surgery, intraoperative findings, and serial follow-ups at 2, 6, 12, and 24 weeks, then 6 and 12 months. Radiological union was assessed using the Radiographic Union Score for Tibia (adapted RUST) on AP and lateral radiographs. Functional outcomes were graded using Klaus and Borner criteria. Complications such as infection, implant failure, malunion (>10°), nonunion, and reoperation were recorded. Statistical analysis was performed using SPSS v25. Descriptive statistics included means and standard deviations; inferential tests comprised chi-square for categorical variables and t-tests for continuous data, with p-value <0.05 considered significant. Power analysis guided sample adequacy.

Results

A total of 35 patients completed the study follow-up. The cohort was predominantly young males involved in road traffic accidents. Mean surgical delay was 4.8 days. All achieved stable fixation.

Table 1: Demographic and Injury Characteristics

Parameter	Value (n=35)
Mean Age (years)	32.4 ± 8.7
Male:Female	29:6 (82.8%:17.2%)
RTA:Fall/Others	28:07:00
Closed:Open (Type I)	31:04:00
Midshaft:Proximal/Distal	24:11:00

Table 2: Weight Bearing Progression and Hospital Stay

Milestone	Mean Time	Range
Partial WB (days)	5.2 ± 2.1	3 – 10
Full WB (weeks)	5.8 ± 1.4	4 – 8
Hospital Stay (days)	9.4 ± 3.2	6 – 18
Return to Work (months)	3.9 ± 1.1	3 – 6

Table 3: Radiological and Functional Outcomes

Outcome	Excellent/Good	Fair/Poor	Mean Union Time
Radiological Union	32 (91.4%)	3 (8.6%)	14.8 weeks
Functional (Klaus-Borner)	31 (88.6%)	4 (11.4%)	-

Table 4: Complications

Complication	Number (%)	Management
Delayed Union	2 (5.7%)	Bone grafting (1), conservative
Superficial Infection	1 (2.9%)	Antibiotics
Implant Failure	0	-
Malunion	0	-
Deep Vein Thrombosis	1 (2.9%)	Anticoagulation

Descriptive analysis showed progressive improvement in knee range of motion (mean 0-120° at 6 months) and no significant correlation between fracture comminution and union time (p=0.12). Early weight bearing group demonstrated faster quadriceps recovery.

Discussion

Early protected weight bearing following stable fixation of femoral shaft fractures represents a paradigm shift from traditional conservative rehabilitation protocols. By allowing axial loading in a controlled manner, this approach aims to harness biomechanical forces for better callus maturation while minimizing disuse-related complications. In our one-year prospective study at a Mumbai tertiary center, we observed satisfactory union rates and functional recovery with low complication profiles, aligning with the evolving evidence supporting accelerated mobilization.[5,6]

Our mean radiological union time of 14.8 weeks compares favorably with the Indian study by Maruthi et al. (2019), which reported enhanced healing with early guarded weight bearing after IM nailing, achieving excellent results in 74% cases. Internationally, Komaki et al. (2024) found no significant differences in implant failure or union between early and late weight bearing groups in distal femoral fractures, reinforcing safety.[7-9]

Functional outcomes in our series (88.6% excellent/good) mirror

findings from Striano et al. (2022) on early weight bearing after distal femur fixation, where no increase in hardware failures occurred. In the Indian context, studies from tertiary centers in Navi Mumbai and Chennai on IM nailing have similarly highlighted early mobilization benefits in reducing hospital stay and improving patient compliance.[10-12]

Regarding complications, our low rate of delayed union (5.7%) and absence of implant failures align with meta-analyses by Ali et al. (2025), showing no significant rise in nonunion or failure with early weight bearing post-IMN. This is crucial in high-volume Indian setups where patient follow-up can be challenging.

Knee range and quadriceps strength recovered faster in our patients initiating partial weight bearing within a week, consistent with Chen et al.'s observations on early loading promoting gait and muscle function. Compared to delayed protocols in older literature, our return-to-work timeline (mean 3.9 months) was notably shorter.

Hospital stay reduction (mean 9.4 days) echoes Indian trauma studies emphasizing early fixation and mobilization to lower socioeconomic impact. No malalignments occurred, likely due to stable nailing and supervised physiotherapy, supporting feasibility in resource-limited tertiary care.[13,14]

Small sample size, single-center design, and lack of a strict control group limit generalizability. Longer-term follow-up beyond one year and randomized comparisons would strengthen findings.

Conclusion

Our one-year prospective study conducted at a tertiary care centre in Mumbai demonstrates that early protected weight bearing following interlocking intramedullary nailing for femoral shaft fractures is a safe and effective rehabilitation approach. It achieved radiological union in an average of 14.8 weeks with excellent to good functional outcomes in 88.6% of patients and minimal complications. The protocol significantly reduced hospital stay and enabled faster return to work, proving particularly beneficial in the urban Indian setting. Our findings align well with previous Indian and international studies. Although limited by sample size and single-centre design, the results support adoption of early protected weight bearing with proper fixation and supervised physiotherapy. This strategy has strong potential to improve patient quality of life and reduce the socioeconomic burden of femoral shaft fractures.

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Conflicts of interest

There are no conflicts of interest.

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