International Journal of Health Sciences and Research
[Indexed, Peer-Reviewed Journal]
Volume 16; Issue: 9; September 2026
Website: www.ijhsr.org
Case Report *ISSN: 2249-9571*

Severe Knee Extensor Lag Following Mid-Shaft Femoral Fracture Treated with IM Nailing and Bone Grafting: Is Late Rehabilitation a Contributing Factor? - A Case Report

S Jeba Malar[1], Anas Ahamed A[2]

[1,2]Physiotherapist, Department of Physical Medicine and Rehabilitation, Government Medical College Hospital, Tirupur, Tamil Nadu, India.

Corresponding Author: S. Jeba Malar

DOI: https://doi.org/10.52403/ijhsr.20260918

Received: 10/05/2026; Revised: 08/08/2026; Accepted: 12/09/2026

ABSTRACT

Background: This case report describes a 23-year-old male with a comminuted mid-shaft femoral fracture who initially received traditional bone setting followed by surgical management with intramedullary interlocking nailing and autologous iliac crest bone grafting. Structured supervised physiotherapy was initiated several months after surgical fixation because of poor adherence related to fear of movement (kinesiophobia).
Aim: To describe the functional changes following a structured supervised physiotherapy programme initiated late after surgical management of a femoral shaft fracture with nonunion, and to document the residual knee extensor lag.
Results: After 8 weeks of supervised physiotherapy, hip and knee range of motion, selected hip muscle strength, pain, swelling, weight-bearing ability and gait improved. Hip abductor strength improved from 1/5 to 3/5 and hip extensor strength from 2/5 to 3/5. Knee extensor strength remained 2/5. Active knee flexion improved from 0–90° to 0–125°. The terminal knee-extension lag improved from 60° to 45° but persisted. Knee circumference at the mid-patellar level decreased from 41 cm to 40 cm, while moderate swelling remained.
Conclusion: Late structured physiotherapy was associated with clinically meaningful improvements in mobility, selected muscle strength, pain and gait. The persistent extensor lag should not be attributed to late rehabilitation alone. Possible contributors include prolonged immobilization, knee effusion with arthrogenic muscle inhibition, kinesiophobia, late weight bearing and fracture-related factors.

Keywords: Intramedullary nailing, bone graft, progressive resisted exercise, quadriceps lag, kinesiophobia

INTRODUCTION

Femoral shaft fractures are common musculoskeletal injuries that may be neglected when patients first seek care from traditional bone setters. One study of neglected femoral shaft fractures reported that open intramedullary nailing can achieve fracture union and improve section of your

research paper here. Modify this section as applicable according to your research work. Aims/objectives of research article should be included in this section.

Add appropriate original references knee motion **[1]**.

Femoral shaft fractures commonly result from high-energy trauma in younger individuals. Deforming forces from the surrounding musculature can contribute to displacement and shortening. Intramedullary nailing is a standard surgical treatment for femoral shaft fractures and facilitates early stabilization and functional recovery **[2]**.

Intramedullary nailing permits early weight bearing, helping preserve muscle strength and joint mobility. Patients can often bear weight as tolerated and resume full or near-full activity before radiographic union, typically indicated by callus formation on three of four cortices on imaging **[3]**.

Progressive physiotherapy rehabilitation is considered essential for optimal recovery after surgically managed distal femur fractures. Although initiated late, a structured intervention significantly improved pain, joint mobility, muscle strength and functional outcomes **[4]**. Autologous iliac crest bone grafting is regarded as the gold standard because it supports bone regeneration and fracture healing through osteoconductive, osteoinductive and osteogenic properties in the treatment of nonunion **[5]**.

This case report describes the outcome of an 8-week structured physiotherapy programme initiated late after surgical treatment of a femoral shaft fracture. The report focuses on the persistent knee extensor lag despite improvement in other clinical outcomes.

CASE PRESENTATION

A 23-year-old male sustained a comminuted mid-shaft fracture of the right femur following a road traffic accident on 28 August 2025 after falling from a two-wheeler. Surgical management was initially advised, but the patient declined surgery and underwent traditional bone setting. Reduction was reportedly inadequate and immobilization continued for approximately two months, resulting in malalignment and limb shortening.

Two months after removal of the external support, the patient continued to have pain at the fracture site, abnormal movement during knee flexion and restricted knee motion. The original case presentation described these findings as suggestive of malalignment and delayed union. The patient subsequently underwent intramedullary interlocking nailing with autologous iliac crest bone grafting.

After surgery, therapeutic exercises were taught, but adherence was poor because of fear of movement. The patient was referred for structured physiotherapy on 7 March 2026. Supervised physiotherapy was provided three times per week for 8 weeks, with completion documented on 7 May 2026.

At initial physiotherapy assessment, the patient had marked weakness of the right lower limb, particularly the quadriceps and gluteal muscles, reduced hip and knee active range of motion, knee and ankle pain during weight bearing, knee swelling, impaired balance and difficulty walking with a walker.

Radiographic Findings

Serial anteroposterior and lateral radiographs demonstrated progressive callus formation on the medial and posterior aspects of the fracture with partial obscuration of the fracture line, consistent with ongoing healing. Progression of weight bearing and strengthening was based on radiological evidence of fracture healing and the opinion of the treating orthopaedic surgeon.

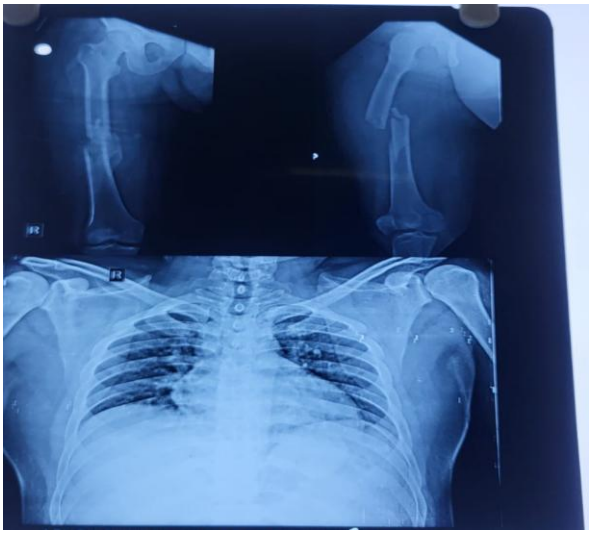

Figure 1. Right femur radiographs dated 15 November 2025 showing the comminuted mid-shaft femoral fracture before surgical fixation.

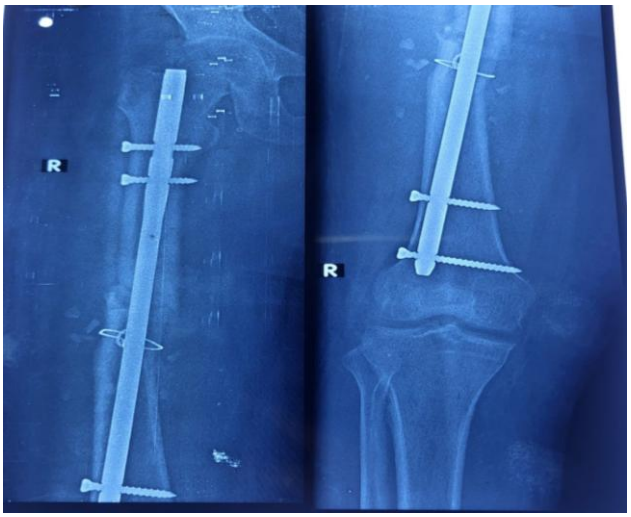

Figure 2. Right femur postoperative radiographs dated 22 November 2025 showing intramedullary interlocking nail fixation.

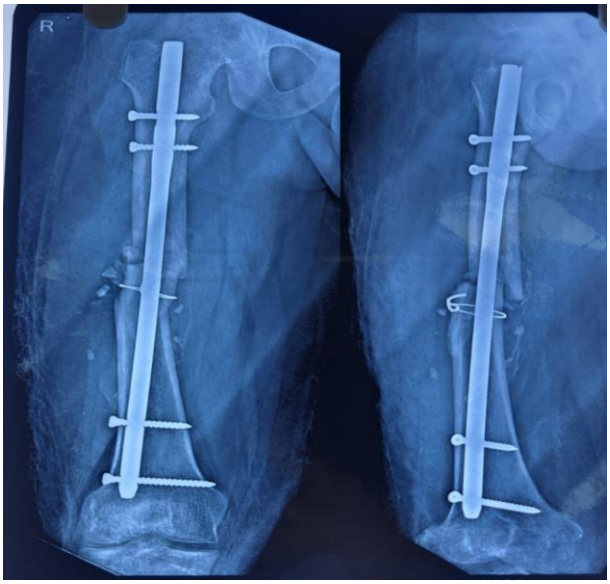

Figure 3. Right femur follow-up radiographs dated 7 March 2026 showing the postoperative fixation at the time structured physiotherapy commenced.

Outcome Measures

Pain was recorded using a Visual Analogue Scale (VAS), with higher scores indicating greater pain. Manual muscle testing was recorded using Medical Research Council (MRC) grading from 0/5 to 5/5. Hip, knee and ankle range of motion was recorded in degrees. Knee extensor lag was defined as the angular difference between the terminal passive knee-extension position and the maximum active knee-extension position.

.

Physiotherapy Management

The programme was delivered three times per week and progressed according to symptoms, available range of motion, muscle activation, weight-bearing tolerance, balance and gait ability.

Weeks 1–2: Active and active-assisted range-of-motion exercises for the hip, knee and ankle, performed as 3 sets of 10 repetitions; adductor, quadriceps and gluteal isometric exercises with 5-second holds for 10 repetitions; and assisted hamstring and gastrocnemius stretching with 10-second holds for 5 repetitions. The patient also received partial weight-bearing gait training with a walker, with a portion of body weight placed on the injured limb. Transcutaneous electrical nerve stimulation was applied at 100 pulses per second for 20 minutes, with two electrodes positioned over the painful distal anterior thigh.

Weeks 3–4: The programme progressed to assisted mini-squats, active-assisted straight-leg raises, short-arc and long-arc quadriceps exercises with terminal passive knee extension, hip-hike exercises and core stability training. Progressive resisted exercises were performed using a light-resistance yellow TheraBand and 0.5 kg ankle weights for 3 sets of 10 repetitions. Static cycling was completed without resistance for 5 minutes, and proprioceptive weight-shifting exercises were performed in parallel bars for 3 sets of 10 repetitions. Interferential therapy was delivered for 15 minutes in quadripolar mode at a rhythmic frequency of 1–10 Hz, with the intensity set to a comfortable, non-painful level and four pad electrodes placed around the knee joint.

Weeks 5–6: Seated vastus medialis oblique and adductor isometric exercises with 10-second holds for 3 sets of 10 repetitions; externally rotated partial squats; quadruped hip extension and abduction; wall bridging; clamshell exercises for 3 sets of 10 repetitions; and partial weight-bearing gait training using two elbow crutches.

Weeks 7–8: Sequential faradism was applied for quadriceps rehabilitation for 20 minutes, using sequential contraction sets of 10 repetitions with rest intervals between sets. The inactive electrode was placed over the proximal anterior thigh, and the active electrode over the distal thigh. Ball-assisted terminal knee-extension training was performed in standing for 3 sets of 10 repetitions, followed by weight bearing as tolerated, with a comfortable amount of weight placed on the limb, and gait training using an elbow crutch on the side opposite the affected limb.

RESULT

After 8 weeks of structured supervised physiotherapy, the patient showed improvement in pain, hip and knee range of motion, selected muscle strength, swelling, weight-bearing ability and gait (table 1, table 2, and table 3). Pain decreased from 6/10 to 1/10, and the patient progressed from partial weight bearing with a walker to weight bearing as tolerated using a single elbow crutch. However, knee extensor strength remained unchanged at 2/5, and although the knee extensor lag improved from 60° to 45°, a significant terminal extension lag persisted**.**

Table 1: Manual Muscle Testing

Muscle group	Pre-rehabilitation (MRC/5)	Post-rehabilitation (MRC/5)
Hip flexors	2	4
Hip extensors	2	3
Hip abductors	1	3
Hip adductors	1	2
Hip external rotators	1	3
Hip internal rotators	1	2
Knee flexors	2	4
Knee extensors	2	2
Ankle dorsiflexors	3	4
Ankle plantar flexors	3	4

Table 2: Active Range of Motion

Joint movement	Pre-rehabilitation AROM	Post-rehabilitation AROM
Hip flexion	80°	100°
Hip extension	10°	20°
Hip abduction	10°	30°
Hip adduction	10°	30°
Hip external rotation	10°	20°
Hip internal rotation	20°	40°
Knee flexion	0–90°	0–125°
Ankle dorsiflexion	10°	20°
Ankle plantar flexion	50°	55°

Table 3: Clinical Parameters

Parameter	Pre-rehabilitation	Post-rehabilitation
Pain (VAS)	6/10	1/10
Mid-patellar knee circumference	Right 41 cm; Left 37 cm	Right 40 cm; Left 37 cm
Weight bearing / gait	Partial weight bearing with walker	weight-bearing as tolerated gait with single elbow crutch
Knee extensor lag	60°	45°

DISCUSSION

The patient demonstrated meaningful improvement in hip and knee mobility, selected muscle strength, pain, swelling, weight-bearing tolerance and gait after 8 weeks of structured supervised physiotherapy. The persistent knee extensor lag was the principal residual impairment.

After bone grafting, donor-site complications may include pain, nerve or arterial injury, peritoneal perforation and sacroiliac joint instability [6]. A previous evaluation-based rehabilitation programme following femoral shaft fracture fixation with intramedullary nailing targeted residual impairments such as limited weight bearing, knee effusion, poor quadriceps control and hip abductor weakness. Such rehabilitation may support more predictable functional recovery [7].

Early weight bearing combined with strengthening exercises after surgical correction of a mid-shaft femoral fracture can promote faster improvement in impairments and functional limitations, including range of motion, hip abductor strength and knee extensor strength [8]. The present case differs in that structured supervised rehabilitation was initiated late. However, because this is a single case, the persistent extensor lag cannot be attributed definitively to late rehabilitation. Possible contributors include prolonged immobilization, late weight bearing, knee effusion and arthrogenic muscle inhibition, reduced neuromuscular control, kinesiophobia

Another study examined etiological factors associated with quadriceps weakness after femoral shaft fracture and found that the

maximum initial fracture displacement on radiographs was the only significant predictor [9]. The original fracture in this case was initially managed with traditional bone setting, and inadequate reduction was reported. The subsequent need for intramedullary nailing and autologous bone grafting is consistent with a difficult healing course. However, the exact contribution of fracture displacement or prior malalignment to the persistent quadriceps deficit cannot be determined from this case alone.

The improvement in pain from 6/10 to 1/10 and progression from partial weight bearing with a walker to weight-bearing as tolerated gait with single elbow crutch indicates functional benefit from rehabilitation. Nevertheless, the persistent 45° terminal extension lag and knee instability demonstrate that improvement in general mobility does not necessarily imply restoration of quadriceps motor control.

In one study quadriceps performance was measured 12 months after surgical fixation of lower extremity fracture. It is found that quadriceps performance was impaired particularly in female participants and in those with kinesiophobia 12 months after surgery [10]. Kinesiophobia was observed during the patient's rehabilitation. Psychological and behavioral factors may influence activity and recovery after lower-extremity fracture.

The case therefore supports the feasibility and potential clinical value of structured supervised rehabilitation even when rehabilitation begins late, while emphasizing that persistent impairment may remain. The findings should be interpreted as hypothesis-generating rather than proof that late rehabilitation caused the extensor lag.

CONCLUSION

An 8-week structured supervised physiotherapy programme initiated late after surgical fixation of a femoral shaft fracture was associated with improvements in active ROM, selected hip and knee muscle function, pain, weight-bearing tolerance and gait. Knee extensor strength remained 2/5, and a terminal active knee-extension lag of approximately 45° persisted. The residual lag may have multiple contributors, including knee swelling/arthrogenic muscle inhibition, prolonged immobilization, kinesiophobia, delayed weight bearing and fracture-related factors. Late rehabilitation should therefore be presented as a possible contributor rather than a proven cause. Early, individualized rehabilitation remains important for addressing quadriceps control, swelling, mobility and gait.

Declaration

Patient's consent: Obtained for publication

Acknowledgement: The authors thank Dr. Yuganeswaran, MS Ortho, Head of the Department, for his valuable guidance; Dr. Faheem Ahmed, MS Ortho, for the surgical intervention; Ms. Subhashree, physiotherapist, for assistance; and the patient for cooperation and regular follow-up.

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Jan WF, Jahan A, Dar MY, Bangaroo FA, Khan I. A study on management of neglected shaft femur fractures by open intramedullary nailing. Int J Res Orthop. 2018;4(4):667-671. doi:10.18203/issn.2455-4510.
2. Kekatpure A, Singh SD, Kale S, Chaudhari P, Dhar S. Management of comminuted fractures of the shaft of femur by interlocking nailing at a tertiary level hospital in India. Int J Res Med Sci. 2016;4(1):289-293. doi:10.18203/2320-6012.ijrms20160045.
3. Denisiuk M, Afsari A. Femoral Shaft Fractures. [Updated 2023 Jan 2]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan-. Available

from: https://www.ncbi.nlm.nih.gov/books/NBK556057/
4. Mrityunjay, Kumari T, Sachan K. Physiotherapy rehabilitation for delayed post-operative management of comminuted distal femur fracture: a case report. Int J Multidiscip Res Dev. 2026;13(1):439-442.
5. Gómez-Barrena E, Ehrnthaller C. Long bone uninfected non-union: grafting techniques. EFORT Open Rev. 2024;9(5):329-338. doi:10.1530/EOR-24-0032.
6. Kurz LT, Garfin SR, Booth RE. Harvesting autogenous iliac bone grafts: a review of complications and techniques. Spine (Phila Pa 1976). 1989;14(12):1324-1331. doi:10.1097/00007632-198912000-00009.
7. Paterno MV, Archdeacon MT. Is there a standard rehabilitation protocol after femoral intramedullary nailing? J Orthop Trauma. 2009;23(5 Suppl): S39-S46. doi:10.1097/BOT.0b013e31819f27c2.
8. Paterno MV, Archdeacon MT, Ford KR, Galvin D, Hewett TE. Early rehabilitation following surgical fixation of a femoral shaft fracture. Phys Ther. 2006;86(4):558-572. doi:10.1093/ptj/86.4.558.
9. Hennrikus WL, Kasser JR, Rand F, Millis MB, Richards KM. The function of the quadriceps muscle after a fracture of the femur in patients who are less than seventeen years old. J Bone Joint Surg Am. 1993;75(4):508-513. doi:10.2106/00004623-199304000-00005.
10. Brightwell BD, Van Wyngaarden JJ, Samaan MA, Matuszewski PE, Jacobs CA, Noehren B. Factors associated with long-term quadriceps muscle function after surgical fixation of lower extremity fractures. Phys Ther. 2023;103(10): pzad108. doi:10.1093/ptj/pzad108.

How to cite this article: S Jeba Malar, Anas Ahamed A. Severe knee extensor lag following mid-shaft femoral fracture treated with IM nailing and bone grafting: is late rehabilitation a contributing factor? - a case report. *Int J Health Sci Res.* 2026; 16(9):160-166. DOI: *https://doi.org/10.52403/ijhsr.20260918*

******