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Physiotherapy rehabilitation for delayed post-operative management of comminuted distal femur fracture: A case report

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Abstract

Background: Distal femur fractures represent complex lower-limb injuries associated with significant functional impairment. Delayed initiation of physiotherapy following surgical fixation can lead to prolonged disability, joint stiffness, muscle weakness, and reduced quality of life.

Case Presentation: This report describes the rehabilitation of a 32-year-old male patient who sustained a comminuted distal one-third right femur fracture following a road traffic accident. The patient underwent open reduction and internal fixation (ORIF) with plates and screws. However, physiotherapy was not initiated immediately post-operatively, resulting in pain, swelling, restricted knee range of motion (ROM), and muscle weakness. The patient was referred for structured physiotherapy rehabilitation approximately two weeks post-surgery. On initial assessment, the patient presented with pain intensity of 4/10 on the Numeric Pain Rating Scale (NPRS), active knee flexion of 30°, passive flexion of 50°, and muscle strength graded at 2+ for the quadriceps and hamstrings.

Intervention: A four-week, progressive, outcome-based physiotherapy program was implemented, incorporating pain management modalities, continuous passive motion (CPM), joint mobilization techniques, progressive strengthening exercises, and functional retraining. Treatment was structured in weekly phases targeting specific goals including pain reduction, ROM improvement, muscle strengthening, and functional independence.

Results: Following four weeks of rehabilitation, significant improvements were observed. Pain intensity reduced to 1/10, active knee flexion improved to 100° and passive flexion to 130°. Quadriceps and hamstring strength improved to Grade 4. The Lower Extremity Functional Scale (LEFS) score improved from 28/80 to 65/80, indicating enhanced functional independence. The patient progressed from being bedbound to performing bed mobility independently, sitting unsupported, and initiating weight-bearing activities.

Conclusion: This case demonstrates that structured, progressive physiotherapy rehabilitation is essential for optimal recovery following surgically managed distal femur fractures. Despite delayed initiation, early and systematic intervention significantly improved pain, joint mobility, muscle strength, and functional outcomes. The findings underscore the importance of timely physiotherapy referral and the role of outcome-based assessment in guiding treatment progression.

Keywords: Distal femur fracture, open reduction internal fixation, physiotherapy rehabilitation, knee stiffness, muscle weakness, functional recovery, continuous passive motion

Introduction

Fractures of the distal femur represent a challenging subset of lower-limb injuries due to their proximity to the knee joint, involvement of complex anatomy, and high risk of functional impairment. Distal femur fractures account for approximately 3–6% of all femoral fractures and commonly result from high-energy trauma such as road traffic accidents in younger individuals and low-energy falls in the elderly population [1, 2]. In young adults, these fractures are frequently associated with comminution and significant soft-tissue damage, leading to prolonged rehabilitation and delayed return to function.

Surgical management using open reduction and internal fixation (ORIF) with plates and screws is considered the gold standard for displaced and comminuted distal femur fractures, as it restores anatomical alignment and provides sufficient stability for early mobilization [3, 4]. Despite successful surgical fixation, patients often experience post-operative complications such as pain, swelling, quadriceps inhibition, reduced knee range of motion, muscle atrophy, and delayed functional recovery if rehabilitation is not initiated early [5].

Physiotherapy plays a crucial role in the post-operative management of distal femur fractures. Early rehabilitation aims to reduce pain and inflammation, prevent joint stiffness, maintain muscle strength, and restore functional mobility [6]. Delayed initiation of physiotherapy has been shown to significantly increase the risk of knee stiffness, prolonged immobilization, and poor functional outcomes [7]. Continuous passive motion (CPM), early isometric exercises, progressive strengthening, and functional retraining have been widely advocated to improve knee mobility and prevent adhesions following surgery [8, 9].

Outcome-based rehabilitation using standardized measures such as the Numeric Pain Rating Scale (NPRS), Lower Extremity Functional Scale (LEFS), and objective goniometric assessment allows clinicians to quantify recovery and guide treatment progression [10, 11]. These measures help correlate improvements in physical impairments with functional independence and quality of life.

The present case report describes the physiotherapy rehabilitation of a young male patient with a surgically managed comminuted distal one-third femur fracture who presented with delayed initiation of physiotherapy. The report highlights the importance of a structured, progressive, and outcome-oriented rehabilitation program in restoring knee function, muscle strength, and overall functional independence.

Case Presentation

Patient Information

A 32-year-old male patient, working in the Fire Control Department, married, right-hand dominant, presented to the physiotherapy department for rehabilitation. The patient sustained an injury on 29 July 2025 following a road traffic accident while riding a motorcycle, during which he was hit from behind by a car and fell onto the road. He had no significant past medical history of hypertension, diabetes mellitus, tuberculosis, or other systemic illnesses. The patient denied any history of smoking or alcohol consumption.

Clinical Findings

The patient complained of persistent pain and swelling around the right knee associated with an inability to walk independently for the past two months. On observation, the patient was found lying in a supine position with the right knee supported in an extension brace. The affected limb was elevated using a pillow. Swelling was present around the right knee joint, and a surgical scar measuring approximately three inches was noted on the lateral aspect of the right lower limb. Redness was observed around the knee region. The patient was bedbound and dependent on a wheelchair for mobility.

Pain was described as dull aching in nature with an intensity of 4/10 on the Numeric Pain Rating Scale (NPRS). Pain was aggravated by knee flexion movements and exercise, while rest and medication provided relief. On palpation, local warmth was present around the surgical site, with mild tenderness graded as Grade 2. No edema or crepitus was noted.

Diagnostic Assessment

Radiographic examination using anteroposterior and lateral views of the right femur confirmed a comminuted fracture of the distal one-third of the femur. Surgical management was performed on 30 July 2025 in the form of open reduction and internal fixation (ORIF) using plates and screws. The patient was admitted for physiotherapy rehabilitation on 15 August 2025 and was formally assessed on 27 August 2025.

Table 1: Initial Assessment Findings

Parameter	Finding
Pain (NPRS)	4/10
Active Knee Flexion	30°
Passive Knee Flexion	50°
Quadriceps Strength	Grade 2+
Hamstring Strength	Grade 2+
LEFS Score	28/80
Mobility Status	Bedbound, wheelchair dependent

Therapeutic Intervention

Following the road traffic accident, the patient underwent surgical fixation for the distal femur fracture. However, immediate post-operative physiotherapy was not initiated. As a result, the patient developed restricted joint movements, significant muscle weakness, swelling, and functional dependency for mobility. A structured four-week progressive physiotherapy rehabilitation program was implemented with the following objectives: pain management, improvement of knee range of motion, strengthening of lower-limb musculature, restoration of functional mobility, and enhancement of overall independence.

Table 2: Four-Week Progressive Physiotherapy Rehabilitation Protocol

Phase	Goals	Interventions
Week 1	Reduce pain and swelling Prevent joint stiffness Maintain circulation	Cryotherapy, ankle-toe movements, isometric exercises (quadriceps, hamstrings, gluteals), patellar mobilization (Grade I-II), active-assisted heel drag, CPM up to 115° for 15-20 minutes
Week 2	Improve knee ROM Initiate muscle strengthening	Progressive CPM (20 min twice daily), active-assisted knee flexion/extension, Mulligan mobilization, muscle energy techniques, strengthening exercises, bed mobility training
Week 3	Improve functional control Prepare for upright activities	Active knee bending, bedside sitting, postural control training, progressive resistance exercises (10-15 reps × 2 sets), continued CPM and stretching
Week 4	Enhance functional independence Prepare for gait training	Strengthening with increased resistance, static standing, weight-shifting exercises, balance and proprioceptive training, functional task training

Results

Following four weeks of structured physiotherapy rehabilitation, the patient demonstrated marked improvements across all outcome measures. Pain intensity reduced to 1/10 on the NPRS. Active knee flexion improved to 100°, with passive flexion reaching 130°. Quadriceps and hamstring strength improved to Grade 4, and ankle musculature improved to Grade 4+. The patient was able to perform bed mobility independently, sit unsupported, and initiate weight-bearing activities. The LEFS score improved to 65/80, indicating significantly enhanced functional independence.

Table 3: Comparison of Pre- and Post-Intervention Outcomes

Outcome Measure	Pre-Intervention	Post-Intervention (4 weeks)
Pain (NPRS)	4/10	1/10
Active Knee Flexion	30°	100°
Passive Knee Flexion	50°	130°
Quadriceps Strength	Grade 2+	Grade 4
Hamstring Strength	Grade 2+	Grade 4
LEFS Score	28/80	65/80
Functional Mobility	Bedbound	Independent bed mobility, unsupported sitting, weight-bearing initiated

The results demonstrated significant improvements across all outcome measures. Knee range of motion increased progressively throughout the rehabilitation period, with the greatest gains observed during weeks three and four. Muscle strength improved consistently following initiation of isometric and progressive resistance exercises. Pain levels showed a steady decline, facilitating better patient participation and adherence to therapy. Functional outcomes, as measured by the LEFS, improved markedly, indicating enhanced independence in activities of daily living.

Discussion

Distal femur fractures pose significant rehabilitation challenges due to their impact on knee joint biomechanics, quadriceps function, and weight-bearing capacity. In the present case, the patient experienced delayed initiation of physiotherapy following open reduction and internal fixation (ORIF), which contributed to pain, swelling, restricted knee range of motion, and muscle weakness at the time of assessment. Similar findings have been reported in previous studies, where delayed mobilization following femoral fracture surgery resulted in joint stiffness, prolonged disability, and delayed functional recovery [6].

One of the major impairments observed in this case was reduced knee range of motion, particularly knee flexion. Post-operative knee stiffness is commonly attributed to pain, joint effusion, capsular tightness, and periarticular adhesions [12]. The use of continuous passive motion (CPM) in this case facilitated gradual improvement in knee flexion by promoting synovial fluid circulation, preventing intra-articular adhesions, and maintaining articular cartilage nutrition [8]. Several studies have demonstrated that CPM, when combined with active mobilization and strengthening exercises, can accelerate recovery of knee mobility following lower-limb surgical procedures [13].

Muscle weakness, particularly of the quadriceps muscle, is a well-documented consequence of femoral fractures and surgical intervention. Arthrogenic muscle inhibition, pain, and prolonged immobilization contribute to reduced muscle activation and subsequent atrophy [14]. In the present case, early initiation of isometric exercises followed by progressive strengthening resulted in gradual improvement in muscle strength from Grade 2+ to Grade 4 over a four-week rehabilitation period. Progressive resistance training has been shown to enhance neuromuscular control, increase muscle cross-sectional area, and restore functional strength [15].

Pain management constituted a key component of the rehabilitation program. A reduction in Numeric Pain Rating Scale (NPRS) scores from 4/10 to 1/10 over four weeks indicated effective pain control achieved through therapeutic exercises, gradual mechanical loading, and functional training. Effective pain reduction is essential for improving patient participation, adherence to rehabilitation programs, and overall functional outcomes [16].

Functional recovery was assessed using the Lower Extremity Functional Scale (LEFS), which demonstrated progressive improvement in the patient's ability to perform activities of daily living. LEFS is a validated and reliable outcome measure widely used to assess functional status in patients with lower-limb musculoskeletal conditions, including post-fracture rehabilitation [10, 17]. Improvements in LEFS scores correlated positively with gains in muscle strength and joint mobility, emphasizing the importance of incorporating functional outcome measures in physiotherapy practice.

Bedside sitting, postural control training, and preparatory functional activities were introduced progressively to restore independence and prevent secondary complications such as pressure sores, deconditioning, and fear of movement. Early functional training has been shown to enhance patient confidence, reduce kinesiophobia, and facilitate a faster return to ambulation and community participation [18].

This case reinforces the significance of early, structured, and outcome-oriented physiotherapy intervention following surgically managed distal femur fractures. Timely rehabilitation not only addresses physical impairments but also accelerates functional recovery, promotes independence, and improves overall quality of life. The integration of multidisciplinary care involving orthopedic surgeons, physiotherapists, and nursing staff is vital for successful post-operative management and optimal patient outcomes [6, 17].

Conclusion

This case report demonstrates that a structured and progressive physiotherapy rehabilitation program is essential for optimal recovery following surgically managed distal femur fractures. Early intervention focusing on pain management, joint mobility, muscle strengthening, and functional training resulted in significant improvements in knee range of motion, muscle strength, and functional abilities. Despite delayed initiation of physiotherapy in this case, systematic and goal-oriented rehabilitation achieved meaningful clinical outcomes.

The use of outcome-based assessment tools allowed for objective monitoring of patient progress and guided appropriate modification of the rehabilitation program. The integration of individualized exercise prescription and functional task training facilitated a gradual return to independence and improved confidence in daily activities. This case highlights the importance of early referral to physiotherapy services following surgical fixation and underscores the role of physiotherapists in multidisciplinary orthopedic care.

Future studies involving larger sample sizes and controlled trial designs are recommended to further validate standardized rehabilitation protocols and optimize long-term functional outcomes in patients with distal femur fractures. Early and comprehensive physiotherapy remains a cornerstone of post-operative management and should be prioritized to minimize complications and enhance recovery.

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Conflict of Interest

The author declares no conflict of interest.

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