



Functional Outcomes of Early Rehabilitation Following Proximal Femur Fracture Fixation in Elderly Patients: A Prospective Comparative Study.

Dr. Nilesh Kumar Agrawal¹, Dr. Reetesh Roshan¹, Dr. Raman Kumar^{1*}, Dr. Santosh Kumar², Dr. Farhan Ahmed Khan³

¹Senior Resident, Department of Orthopaedics, IGIMS, Patna, Bihar, India.

²Professor and HOD, Department of Orthopaedics, IGIMS, Patna, Bihar, India.

³Junior Resident, Department of Orthopaedics, IGIMS, Patna, Bihar, India.

Abstract

Background:

Proximal femur fractures in elderly patients are associated with impaired mobility, poor functional outcomes, and prolonged hospitalization. Early postoperative rehabilitation may enhance recovery and improve clinical outcomes.

Objective:

To compare functional outcomes, mobility, and hospital stay between early and conventional rehabilitation following proximal femur fracture fixation in elderly patients.

Methods:

This prospective comparative study included 60 elderly patients (≥ 60 years) undergoing surgical fixation of proximal femur fractures at IGIMS, Patna. Patients were allocated to early rehabilitation (within 48 hours; $n=30$) or conventional rehabilitation (postoperative day 5; $n=30$). Functional outcome was assessed using the Harris Hip Score (HHS), mobility by the Timed Up and Go (TUG) test, and duration of hospital stay. Follow-up was conducted up to 12 months.

Results:

The early rehabilitation group demonstrated significantly better HHS scores (80.27 ± 8.0 vs. 71.35 ± 9.1), shorter TUG times (14.96 ± 3.0 vs. 18.32 ± 4.1 seconds), and reduced hospital stay (6.85 ± 1.5 vs. 9.67 ± 2.0 days) compared with the conventional rehabilitation group (all $p < 0.001$).

Conclusion:

Early rehabilitation following proximal femur fracture fixation significantly improves functional recovery, mobility, and reduces hospital stay in elderly patients.

Recommendation:

Early postoperative rehabilitation should be incorporated into standard care protocols for elderly patients undergoing proximal femur fracture fixation.

Keywords: Proximal femur fracture; elderly; early rehabilitation; functional outcome; Harris Hip Score.

Submitted: January 20, 2026 **Accepted:** February 20, 2026 **Published:** March 30, 2026

Corresponding Author: Raman Kumar

Email: ramanpmch@gmail.com

Senior Resident, Department of Orthopaedics, IGIMS, Patna, Bihar, India.

Introduction

Proximal femur fractures represent a major public health concern among the elderly population. These fractures are frequently associated with osteoporosis and low-energy trauma such as falls, and their incidence is increasing as the global population ages (1).

Despite advances in surgical techniques and postoperative care, many older patients experience chronic impairment following these fractures. Reduced mobility, muscle weakness, and prolonged immobilization can lead to complications such as pressure sores, deep vein thrombosis, and pneumonia, all of which contribute to a poorer quality



of life (2). Early postoperative rehabilitation has been proposed as a strategy to improve recovery, with early mobilization and physiotherapy thought to promote earlier ambulation, restore joint mobility, and strengthen muscles (3).

Assessing functional outcomes is essential for evaluating the effectiveness of rehabilitation strategies. The Harris Hip Score is widely used to assess hip function, pain, and mobility after hip surgery, while mobility tests such as the Timed Up and Go test provide an objective measure of functional performance. The purpose of this study was therefore to compare the functional outcomes of early versus conventional rehabilitation in elderly patients undergoing surgical fixation of proximal femur fractures (4).

Methods

Study Design and Setting

This prospective comparative study was conducted in the Department of Orthopaedics, Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar, India, over a period of one year. Participants were followed up at 1, 3, 6, and 12 months after surgery.

Participants and Recruitment

Patients admitted to the orthopedic ward with proximal femur fractures and undergoing surgical fixation were screened for eligibility. Participants were recruited using a consecutive sampling technique, whereby all eligible patients presenting during the study period were invited to participate.

Inclusion Criteria

- Age ≥ 60 years.
- Radiologically confirmed proximal femur fracture.
- Undergoing surgical fixation with internal fixation devices.
- Medically stable for postoperative rehabilitation.
- Provided written informed consent.

Exclusion Criteria

- Pathological fractures.
- Polytrauma patients.
- Severe cognitive impairment interfering with rehabilitation participation.
- Neurological disorders affecting mobility.
- Patients unable to participate in rehabilitation exercises.

Sample Size and Group Allocation

A total of 60 elderly patients who fulfilled the eligibility criteria were enrolled. Participants were assigned to one of two rehabilitation groups according to the postoperative rehabilitation protocol implemented, with the individual patient as the unit of assignment.

Baseline demographic and clinical characteristics were compared between groups to assess comparability and reduce potential selection bias.

Intervention Protocol

The rehabilitation program was delivered individually under the supervision of qualified physiotherapists in the orthopedic postoperative ward and included:

- Ankle pump exercises to improve circulation and reduce the risk of deep vein thrombosis.
- Quadriceps and gluteal strengthening exercises.
- Active and passive range-of-motion exercises for the hip and knee joints.
- Bed mobility and transfer training.
- Sitting balance exercises.
- Assisted with standing and weight-bearing exercises as tolerated.
- Gait training using walkers or crutches.
- Progressive ambulation according to patient tolerance.

Each rehabilitation session lasted approximately 30–45 minutes and was conducted once daily for five to six days per week until hospital discharge. Compliance with the rehabilitation program was monitored through physiotherapy records and daily attendance documentation.

Outcome Measures

The primary outcome was functional recovery, assessed using the Harris Hip Score (HHS), a validated and reliable instrument for evaluating pain, function, deformity, and range of motion following hip surgery.

Secondary outcomes included mobility, assessed using the Timed Up and Go (TUG) test, a validated measure of functional mobility and balance in elderly individuals, and duration of hospital stay (days). All outcome assessments were performed using standardized procedures by trained healthcare personnel.

Data Collection

Baseline demographic characteristics, fracture type, and clinical information were recorded at enrollment. Functional



and mobility assessments were performed during scheduled follow-up visits at 1, 3, 6, and 12 months postoperatively.

Blinding

Blinding of participants and physiotherapists was not feasible due to the nature of the intervention. However, standardized assessment procedures were used to minimize observer bias during outcome evaluation.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequencies and percentages. Independent-sample t-tests were used to compare continuous variables between groups, and chi-square tests were used to compare categorical variables. Statistical significance was set at $p < 0.05$. The individual patient served as both the unit of assignment and the unit of analysis; all enrolled participants who completed follow-up assessments were included in the

final analysis, and there were no missing data requiring imputation.

Ethical Considerations

The study was approved by the Institutional Ethics Committee of Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar, India. Written informed consent was obtained from all participants before enrollment, and the study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Results

All eligible participants completed the study and were included in the final analysis, with no patients lost to follow-up. Figure 1 illustrates participant progression through enrollment, allocation, follow-up, and analysis.

The baseline demographic and clinical characteristics of the participants are presented in Table 2. No statistically significant differences were observed between the groups with respect to age, sex distribution, or fracture type, indicating that the groups were comparable at baseline ($p > 0.05$ for all comparisons).

Table 1: Baseline Characteristics

Variable	Early Rehabilitation (n=30)	Standard Rehabilitation (n=30)	p-value
Mean age (years)	71.2 $\pm$ 6.8	72.5 $\pm$ 7.1	0.36
Male (%)	40%	42%	0.82
Female (%)	60%	58%	0.82
Intertrochanteric fractures	64%	62%	0.84
Femoral neck fractures	36%	38%	0.81

Functional and mobility outcomes are presented in Table 3. Compared with the conventional rehabilitation group, patients undergoing early rehabilitation had a significantly higher mean Harris Hip Score (80.27 $\pm$ 8.0 vs 71.35 $\pm$ 9.1,

$p < 0.001$), a significantly shorter TUG test time (14.96 $\pm$ 3.0 vs 18.32 $\pm$ 4.1 seconds, $p < 0.001$), and a significantly shorter hospital stay (6.85 $\pm$ 1.5 vs 9.67 $\pm$ 2.0 days, $p < 0.001$).

Table 2: Functional and Mobility Outcomes

Outcome	Early Rehabilitation (n=30)	Standard Rehabilitation (n=30)	p-value
Harris Hip Score	80.27 ± 8.0	71.35 ± 9.1	<0.001
Timed Up and Go test (seconds)	14.96 ± 3.0	18.32 ± 4.1	<0.001
Hospital stay (days)	6.85 ± 1.5	9.67 ± 2.0	<0.001

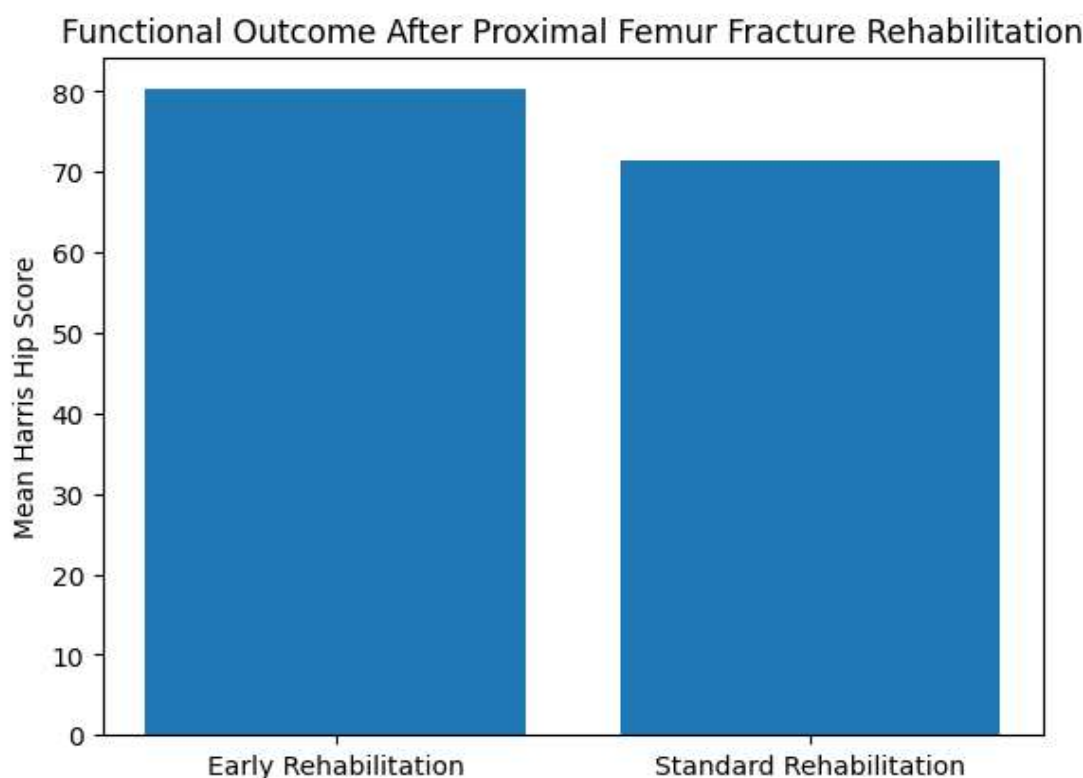


Figure 1: Functional outcome after proximal femur fracture rehabilitation.

Discussion

The present study evaluated the functional outcomes of early rehabilitation following proximal femur fracture fixation in elderly patients. Patients who commenced rehabilitation within 48 hours after surgery achieved significantly better functional recovery, improved mobility, and shorter hospital stays compared with those who received conventional rehabilitation.

These findings suggest that initiating rehabilitation within the first 48 hours after surgery contributes substantially to postoperative recovery in elderly patients with proximal

femur fractures. Early mobilization may enhance muscle strength, maintain joint range of motion, improve balance and coordination, and facilitate earlier restoration of functional independence. In addition, early rehabilitation may reduce the negative consequences of prolonged bed rest, including muscle atrophy, joint stiffness, pressure ulcers, pulmonary complications, and venous thromboembolism (5).

These findings are consistent with those reported by Tang et al., who demonstrated that early rehabilitation in elderly hip fracture patients significantly reduced hospital stay and



improved postoperative functional outcomes (6). Similarly, Alito et al. reported that early rehabilitation programs were associated with better mobility and greater independence in activities of daily living following hip fracture surgery (7). Zheng et al. also observed improved one-year functional outcomes among geriatric patients who underwent structured postoperative rehabilitation (5). The agreement between these studies and the present findings strengthens the evidence supporting early rehabilitation as an important component of postoperative care in elderly fracture patients. The superior Harris Hip Scores observed among patients receiving early rehabilitation may be explained by the positive effects of early physiotherapy on muscle conditioning and joint function. Early exercise interventions promote circulation, reduce edema, maintain muscle mass, and improve neuromuscular coordination, factors that facilitate faster recovery of hip function and allow patients to regain independence more effectively than delayed rehabilitation approaches (7,8,9).

Likewise, the significantly better TUG test performance among the early rehabilitation group reflects improved mobility and balance. Early ambulation encourages confidence during movement and helps patients recover walking ability more rapidly. Improved mobility is particularly important in elderly patients because it decreases the risk of secondary complications associated with immobility and contributes to a better quality of life.

The shorter duration of hospital stay observed in the early rehabilitation group may be attributable to faster functional recovery and reduced postoperative complications. Earlier achievement of mobility milestones allows patients to meet discharge criteria sooner, thereby reducing healthcare costs and optimizing hospital resource utilization. This finding is clinically important given the increasing burden of proximal femur fractures among the aging population.

Generalizability

The findings of this study may apply to elderly patients undergoing surgical fixation of proximal femur fractures in similar tertiary care settings where structured rehabilitation services are available. The observed benefits of early rehabilitation support its integration into standard postoperative orthopedic care for elderly patients.

Conclusion

Following proximal femur fracture fixation, early rehabilitation significantly improves functional outcomes, increases mobility, and shortens hospital stay for elderly patients. Implementation of early physiotherapy protocols

may therefore be important for enhancing recovery and quality of life in this population.

Limitations

Several limitations should be acknowledged. First, this study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other healthcare settings. Second, the sample size was relatively small, which may reduce the statistical power of the study. Third, the non-randomized allocation of participants may have introduced selection bias. Finally, although follow-up assessments were performed, longer-term follow-up may be necessary to determine the sustained effects of early rehabilitation on functional outcomes and quality of life.

Recommendations

Based on the findings of this study, early rehabilitation should be incorporated into routine postoperative management protocols for elderly patients undergoing proximal femur fracture fixation. Early mobilization and structured physiotherapy may improve functional recovery, enhance mobility, and reduce hospital stay. Future multicenter randomized controlled trials with larger sample sizes and longer follow-up durations are recommended to further validate these findings and establish standardized rehabilitation guidelines.

Acknowledgements

The authors would like to express their sincere gratitude to the Department of Orthopaedics, Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar, India, for providing the necessary facilities and support for conducting this study. The authors also thank all patients who willingly participated in the study and contributed to its successful completion.

Funding

The authors received no external funding for this study. The research was conducted using departmental resources only. The funding body had no role in the study design, data collection, data analysis, manuscript preparation, interpretation of results, or the decision to submit the manuscript for publication.

Conflict of Interest

The authors declare no conflicts of interest regarding the publication of this study.



Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Author Contributions

Nilesh Kumar Agrawal: Conceptualization, methodology, data collection, data analysis, manuscript drafting, and revision.

Reetesh Roshan: Data collection, patient follow-up, literature review, and manuscript preparation.

Raman Kumar: Study design, data interpretation, manuscript drafting, corresponding author responsibilities, and critical revision of the manuscript.

Santosh Kumar: Supervision of the study, methodological guidance, interpretation of findings, and final approval of the manuscript.

Farhan Ahmed Khan: Data collection, patient assessment, data entry, and literature review.

All authors read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

List of Abbreviations

HHS – Harris Hip Score

TUG – Timed Up and Go Test

IGIMS – Indira Gandhi Institute of Medical Sciences

SD – Standard Deviation

ROM – Range of Motion

Author Biographies

Dr. Nilesh Kumar Agrawal is a Senior Resident in the Department of Orthopaedics at Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar, India. His research interests include trauma surgery, fracture management, and postoperative rehabilitation.

Dr. Reetesh Roshan is a Senior Resident in the Department of Orthopaedics at IGIMS, Patna, Bihar, India. His academic interests include orthopedic trauma, geriatric orthopedics, and functional outcome assessment.

Dr. Raman Kumar is a Senior Resident in the Department of Orthopaedics at IGIMS, Patna, Bihar, India. His areas of interest include orthopedic trauma, rehabilitation, and clinical research in musculoskeletal disorders.

Dr. Santosh Kumar is Professor and Head of the Department of Orthopaedics at IGIMS, Patna, Bihar, India. His expertise includes orthopedic trauma, joint reconstruction, and orthopedic education.

Dr. Farhan Ahmed Khan is a Junior Resident in the Department of Orthopaedics at IGIMS, Patna, Bihar, India. His interests include orthopedic trauma care, fracture rehabilitation, and clinical research.

References

1. Shekhawat V, Jangir A, Laddha GK. Proximal Femoral Fractures Treatment, Outcomes, and Complications. *Eur J Cardiovasc Med (EJCM)*. 2026;16(01):241-5.
2. Tittel S, Burkhardt J, Roll C, Kinner B. Clinical pathways for geriatric patients with proximal femoral fracture improve process and outcome. *Orthop Traumatol Surg Res*. 2020;106(1):141-7. Available from: <https://doi.org/10.1016/j.otsr.2019.07.029>
3. Aborukbah AF, Alfaleh TA, Alenazi HM, Alsulami AK, Alshahrani AA, Aloraifi MA, et al. Exercise protocols for improving functional outcomes in hip fractures. *Int J Community Med Public Heal*. 2024;11(12):5002-5. <https://doi.org/10.18203/2394-6040.ijcmph20243452>
4. Zalavadiya HU. Functional outcomes following surgical management of proximal femoral fractures: A retrospective study. *Indian J Orthop Surg*. 2025;11(3):23640. <https://doi.org/10.18231/j.ijos.12791.1760086942>
5. Zheng W, Cai Q, Zhang C, Chen S, Feng K. One-Year Functional Outcomes Following Geriatric Hip Fracture: A Prospective Cohort. *Orthop Surg*. 2025;17:2130-40. <https://doi.org/10.1111/os.70081>
6. Tang W, Wang Y, He Y, Liu B, Yuan R, Zhou Y. Effect of early rehabilitation on hospital stay and postoperative complications in elderly hip fracture patients: a prospective cohort study. *J Orthop Surg Res*. 2025;20(84):1-8. <https://doi.org/10.1186/s13018-024-05354-y>
7. Alito A, Fenga D, Portaro S, Leonardi G, Borzelli D, Sanzarello I, et al. Early Hip Fracture Surgery and Rehabilitation. How to Improve Functional Quality Outcomes. A Retrospective Study. *Folia Med (Plovdiv)*. 2023;65(6):879-84. <https://doi.org/10.3897/folmed.65.e99513>
8. Res JM, Fischer H, Maleitzke T, Eder C, Ahmad S, Stöckle U, et al. Management of proximal femur fractures in the elderly: current concepts and treatment options. *Eur J Med Res*. 2021;26(86):1-



Student's Journal of Health Research Africa

e-ISSN: 2709-9997, p-ISSN: 3006-1059

Vol.7 No. 3 (2026): March 2026 Issue

<https://doi.org/10.51168/sjhrafrica.v7i3.2617>

Original Article

15. Available from: <https://doi.org/10.1186/s40001-021-00556-0>
9. Cohn MR, Cong G, Nwachukwu BU, Patt ML, Desai P, Zambrana L, et al. Factors Associated With Early Functional Outcome After Hip Fracture Surgery. *Geriatr Orthop Surg Rehabil.* 2016;7(1):3-8. <https://doi.org/10.1177/2151458515615916>
- 10.

PUBLISHER DETAILS:

Student's Journal of Health Research (SJHR)

(ISSN 2709-9997) Online

(ISSN 3006-1059) Print

Category: Non-Governmental & Non-profit Organization

Email: studentsjournal2020@gmail.com

WhatsApp: +256 775 434 261

**Location: Scholar's Summit Nakigalala, P. O. Box 701432,
Entebbe Uganda, East Africa**

