

Primary Total Hip Arthroplasty for Femoral Neck Fractures in the Elderly: Clinical and Radiological Outcomes

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Abstract

Background: The management of femoral neck fracture in elderly patients above 60 years of age remains controversial. Although internal fixation is one of the surgical options, it is associated with high failure rates due to complications such as non-union and varus collapse. Hemiarthroplasty also has inherent complications, including acetabular erosion, secondary arthritis, and protrusio acetabuli. Primary total hip arthroplasty (THA) offers a stable hip joint with excellent functional outcomes.

Methods: This study was conducted at a tertiary care institute between January 2020 and June 2024. A total of 48 THAs were performed in 47 patients as a primary procedure for femoral neck fracture. All procedures were cemented total hip replacements and were performed by a single surgeon. Preoperative evaluation was carried out using the Harris Hip Score (HHS). Radiological assessment was performed using standard radiological parameters.

Results: At the end of the follow-up period, the mean HHS was 86.3 (range: 77-97). Of the 48 hips, 16 demonstrated excellent outcomes (HHS > 90), 27 showed good outcomes (HHS: 80-89), and 5 had fair outcomes (HHS: 70-79). Complications included three cases of superficial infection and four cases of deep vein thrombosis (DVT).

Conclusion: Primary THA is an excellent alternative to internal fixation and hemiarthroplasty in the management of femoral neck fracture in elderly patients. The study also suggests that the modified lateral approach is a safer surgical approach in reducing the risk of dislocation.

Keywords: Femoral Neck Fractures; Total Hip Arthroplasty; Hemiarthroplasty; Elderly

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Background

Femoral neck fracture is one of the most commonly encountered fractures in the geriatric population. With ongoing advances in healthcare, life expectancy has increased significantly, leading to a corresponding rise in the incidence of femoral neck fractures. The annual global incidence is estimated to increase from 1.7 million in 1990 to 6.3 million by the year 2050. Femoral neck fracture accounts for approximately 7% of all fractures. Owing to poor bone quality and the highly osteoporotic nature of bones in elderly individuals, even a minor fall can result in a fracture of the neck of the femur (1, 2).

The management of femoral neck fracture in patients aged over 60 years remains controversial and continues to be a subject of debate (3). Although internal fixation is one of the surgical options, it is associated with high failure rates due to complications such as non-union, varus collapse, and implant failure, particularly in osteoporotic bone (4).

Hemiarthroplasty is the most commonly employed treatment modality for the neck of femur fracture in elderly patients. While it avoids complications related to internal fixation, hemiarthroplasty has its own set of complications, including acetabular erosion, secondary arthritis, and protrusio acetabuli. These complications may necessitate revision surgeries, which are associated with increased morbidity and higher rates of infection (5, 6).

Primary total hip arthroplasty (THA) has emerged as an effective treatment option for the neck of femur fracture in elderly patients. It provides a stable and

functional hip joint while avoiding complications associated with hemiarthroplasty, such as acetabular erosion and secondary arthritic changes, thereby significantly reducing morbidity (7).

The aim of this study was to assess the functional and radiological outcomes of patients aged over 60 years with femoral neck fracture treated with primary THA and to compare the results with those of similar studies reported in the literature.

Methods

A prospective, observational study was conducted at a single tertiary care institute between January 2020 and June 2024. Institutional Ethics Committee approval was obtained prior to initiation of the study (IEC/2019/39). Written informed consent was obtained from all patients included in the study. The study was conducted in accordance with the principles laid down in the Declaration of Helsinki.

Patients aged over 60 years who underwent primary THA for neck of femur fracture were included in the study. The inclusion criteria comprised patients aged above 60 years with neck of femur fracture treated with primary THA, Garden type III and IV fractures, and untreated non-union of femoral neck fracture.

Exclusion criteria included patients aged less than 60 years, those with chronic arthritis, pathological fractures, failed osteosynthesis, failed hemiarthroplasty, and Garden type I and II fractures.



Table 1. Harris Hip Score (HHS)

HHS	
Pain (check one)	
None or ignores it (44)	
Slight, occasional, no compromise in activities (40)	
Mild pain, no effect on average activities, rarely moderate pain with unusual activity; may take aspirin (30)	
Moderate pain, tolerable but makes concession to pain. Some limitations of ordinary activity or work. May require Occasional pain medication stronger than aspirin (20)	
Marked pain, serious limitation of activities (10)	
Totally disabled, crippled, pain in bed, bedridden (0)	
Limp	
None (11)	
Slight (8)	
Moderate (5)	
Severe (0)	
Support	
None (11)	
Cane for long walks (7)	
Cane most of time (5)	
One crutch (3)	
Two canes (2)	
Two crutches or not able to walk (0)	
Distance walked	
Unlimited (11)	
Six blocks (8)	
Two or three blocks (5)	
Indoors only (2)	
Bed and chair only (0)	
Sitting	
Comfortably in ordinary chair for one hour (5)	
On a high chair for 30 minutes (3)	
Unable to sit comfortably in any chair (0)	
Enter public transportation	
Yes (1)	
No (0)	

HHS: Harris Hip Score

All procedures were performed by a single surgeon using the modified Hardinge (lateral) approach. Preoperative assessment and functional evaluation were carried out using the Harris Hip Score (HHS) system (8) (Table 1).

Injection of Clexane was administered for prophylactic thrombosis prevention for five days and oral anti-coagulant in the form of aspirin was given for one month in all the cases. Regular follow-up was conducted at 6 weeks, 12 weeks, and 20 weeks, during which relevant clinical and radiological data were collected. Radiographs were obtained at each follow-up visit and evaluated for any radiological abnormalities.

In cases of untreated non-union of femoral neck fracture, the preoperative HHS score ranged from 56 to 100, with a mean of 81.64. Anteroposterior (AP) radiographs of the pelvis were obtained preoperatively to assess the hip joint, facilitate surgical planning and templating, evaluate bone quality, determine the extent of displacement and fracture pattern, and classify fractures according to Garden's classification.

The minimum follow-up duration was 6 months and the maximum was 4 years and 6 months, with a mean follow-up period of 2.8 years. Clinical and functional outcomes were assessed using the modified HHS. Radiological evaluation was performed using standard AP radiographs of the pelvis and affected hip, assessing acetabular and femoral anteversion and inclination, as well as the presence of loosening and osteolysis.

Radiolucency and osteolysis were evaluated using the DeLee and Charnley classification (9), which divides the acetabulum into three equal zones, with zone I being the most lateral and zone III the most medial. As described by Gruen et al., the femoral component and its associated interfaces were divided into seven zones for femoral

component assessment (10).

Statistical Analysis

The sample size was calculated using G*Power software. Assuming a small effect size of 0.25, a significance level of 5%, and a power of 80%, the required sample size was determined to be 48 subjects. Accordingly, 48 eligible subjects were included in the study. Data were analyzed using SPSS software (version 22, IBM Corporation, Armonk, NY, USA).

Categorical variables were expressed as frequencies and percentages, while continuous variables were expressed as the mean and standard error of the mean (SEM). Descriptive statistics were calculated using frequencies and percentages. The chi-square test was used to assess significant differences among categorical variables. A P-value < 0.05 was considered statistically significant.

Results

The age of the patients ranged from 60 to 80 years, with a mean age of 67 years. The most common mechanism of injury was a fall at home, accounting for 40 out of the 48 cases (83%). Twenty-five fractures were right-sided, 21 were left-sided, and one patient sustained a bilateral neck of femur fracture. Based on the Garden classification, 19 fractures were classified as Garden type III, while the remaining fractures were Garden type IV (Table 2).

Garden's type	n (%)
1	0 (0)
2	0 (0)
3	20 (35)
4	28 (65)

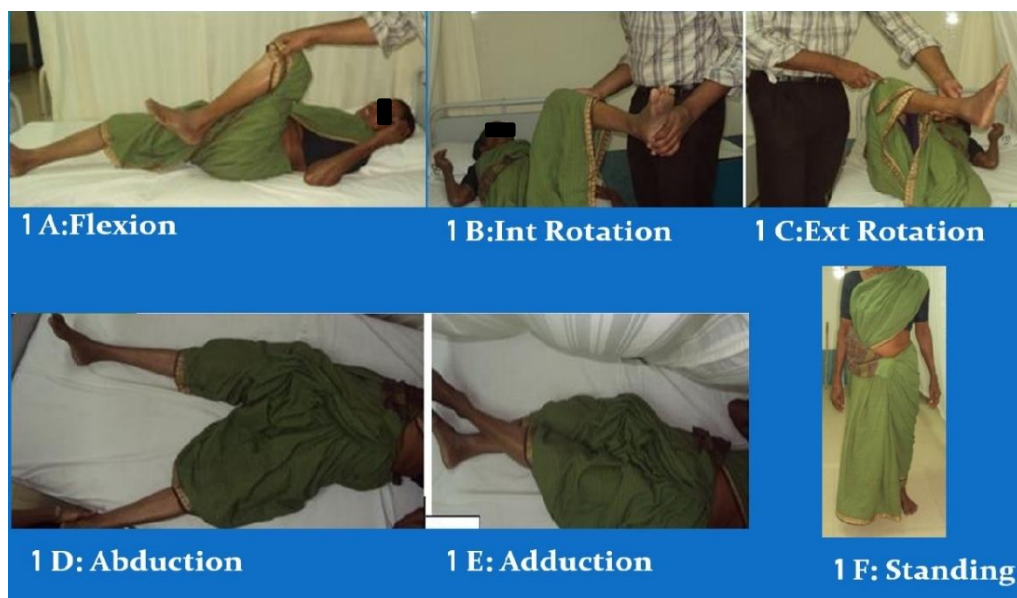


Figure 1. A-F) Functional outcome with range of motion (ROM)

Thirty out of the 48 patients had associated comorbid conditions, with diabetes mellitus (DM) and hypertension (HTN) being the most common, present in 15 and 10 patients, respectively. The duration of hospital stay ranged from 12 to 15 days, with a mean stay of 12.8 days. One patient died on the 10th postoperative day due to pulmonary embolism (PE).

Clinical outcomes were evaluated using the HHS. At the end of the follow-up period, the mean HHS was 86.3 (range: 77-97). Of the 48 hips, 16 demonstrated excellent outcomes with an HHS greater than 90 (Figure 1A-F).

Twenty-seven hips demonstrated good outcomes with HHS between 80 and 89, while five hips showed fair outcomes with scores ranging from 70 to 79 (Table 3). Limb length shortening was observed in 10 patients, ranging from 0.5 cm to 1.5 cm, with a mean shortening of 0.8 cm.

Table 3. Clinical results according to Harris Hip Score (HHS)		
HHS	Grading	n (%)
90-100	Excellent	16 (35)
80-89	Good	27 (55)
70-79	Fair	5 (10)
<70	Poor	0 (0)

HHS: Harris Hip Score

With regard to radiological analysis, the mean postoperative acetabular inclination was 44.2 degrees (range: 30-50 degrees). The mean acetabular cup anteversion was 12 degrees (range: 4-18 degrees).

The mean postoperative femoral component inclination was 40 degrees (range: 30-50 degrees), and the mean femoral component anteversion was 11.3 degrees (range: 5-29 degrees) (Figure 2A-C).

Radiolucency was observed in two cemented femoral components –one in zone II and another involving zones I and VII –and in one acetabular component. In all cases, the radiolucency was non-progressive over a follow-up period of up to three years. The patient with radiolucency in zone II also demonstrated femoral stem subsidence at the end of a four-year follow-up. Both patients with femoral radiolucency showed cement mantle fractures; however, they remained asymptomatic, and no progression of radiolucency was observed during follow-up. No cases of component loosening were noted in the study.

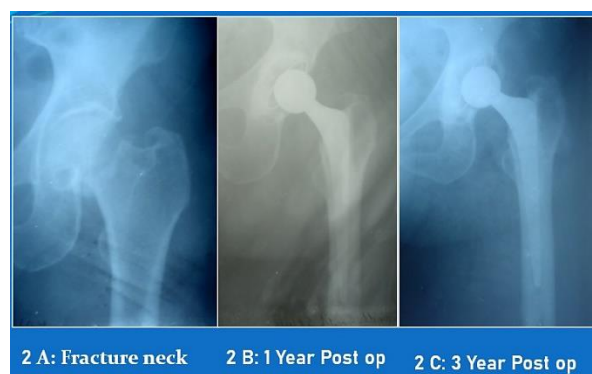


Figure 2. A-C) Neck of femur fracture and radiological outcome

Three cases of superficial surgical site infection (SSI) were encountered, all of which were successfully managed with oral antibiotics and regular wound dressing. Four patients developed deep vein thrombosis (DVT). One patient suffered a PE and died on the 10th postoperative day. This case was excluded from the study. There were no incidences of dislocation or revision surgery during the follow-up period.

Discussion

There is no role for conservative management in displaced fractures of the neck of the femur in the elderly age group. Internal fixation has been proposed as a treatment option; however, owing to poor bone quality and increased osteoporosis in elderly patients, high rates of complications such as non-union, fixation failure, and varus collapse have been reported with this method (11, 12). Consequently, treatment trends have shifted toward arthroplasty procedures for neck of femur fracture in elderly patients.

Hemiarthroplasty, particularly bipolar hemiarthroplasty, is commonly performed in this population. Nevertheless, it is associated with inherent limitations, especially in patients with longer life expectancy. Complications such as acetabular erosion,

secondary arthritis, and protrusio acetabuli are more likely to occur over time, often necessitating revision surgery (13). THA serves as a definitive solution not only for failed internal fixation but also for failed hemiarthroplasty requiring revision. Primary THA has been shown to result in fewer failures and reoperations, improved functional outcomes, and reduced pain during rehabilitation. Hence, this study was conducted to evaluate the role of primary THA in patients aged over 60 years presenting with neck of femur fracture.

In the present study, 48 cases with neck of femur fracture aged 60 years and above were treated with primary THA. Functional outcomes were assessed using the modified HHS, and radiological evaluation was performed using established parameters. The mean age of patients was 67 years. The most common mechanism of injury was a trivial fall, accounting for approximately 85% of cases. Garden type III fractures constituted 35% of cases, while the remaining 65% were Garden type IV fractures. Thirty patients had associated comorbidities.

Mortality following neck of femur fracture remains a significant concern. Coates and Armour reported a mortality rate of 29%, primarily due to complications such as PE and cardiovascular disease (CVD) (14). Delamarter and Moreland reported a mortality rate of 12% in their series (15). Recent advances in medical technology, perioperative care, and treatment strategies have contributed to a reduction in mortality rates in recent years.

Functional outcomes in the present study were graded using the modified HHS. Of the 48 hips evaluated, 16 demonstrated excellent outcomes, 27 had good outcomes, and 5 had fair outcomes, with 90% of patients achieving excellent to good results. Comparable results have been reported in the literature. Taine and Armour observed good to excellent outcomes in 70% of patients (16), while Gregory et al. reported good to excellent results in 94% of cases (17). Similarly, Subash et al. reported good to excellent outcomes in 91% of their study population (18) (Table 4).

Series	Excellent and good outcome (%)
Taine and Armour (16)	70
Gregory et al. (17)	94
Subash et al. (18)	91
Present study	90

In the present study, the mean acetabular inclination was 44.2°, and the mean acetabular cup anteversion was 12.0° (range: 4°-18°). The mean postoperative inclination of the femoral component was 40.0°, while the mean femoral component anteversion was 11.3°. All radiological parameters were within the acceptable and recommended ranges. Similar radiological outcomes have been reported by Kumar et al., who demonstrated comparable values across all measured parameters (19).

With regard to complications, three cases of superficial SSI were encountered, all of which were resolved with oral antibiotics and regular wound care. Four patients developed DVT. One patient suffered a PE and died on the 10th postoperative day. There were no incidences of dislocation or revision surgery in the present study. In contrast, Sim and Stauffer reported a dislocation rate of 10.7% following THA for neck of femur fracture (20).

Treatment trends for neck of femur fracture in elderly patients are gradually shifting from hemiarthroplasty toward THA. Previously, THA was not considered a first-line

treatment due to concerns regarding dislocation risk and cardiopulmonary complications associated with cementing. However, with improved soft-tissue handling, the use of safer lateral surgical approaches, and advancements in perioperative medical care, these risks can be effectively minimized. The present study demonstrates that dislocation can be avoided and medical complications adequately managed. Therefore, primary THA can be considered a safe and effective alternative to internal fixation and hemiarthroplasty for femoral neck fracture, offering superior functional outcomes and lower revision rates.

Limitations: This study has certain limitations. First, the sample size was relatively small, and a larger cohort is required to draw definitive conclusions. Second, the study lacked randomization and did not include a comparative group treated with alternative modalities such as internal fixation or hemiarthroplasty. Besides, there are other limitations such as single surgeon bias, lack of blinding, and lack of long-term survivorship analysis.

Conclusion

Primary THA is a better alternative to internal fixation and hemiarthroplasty for the management of neck of femur fracture in elderly patients. The findings of this study suggest that the modified lateral approach is a safer surgical technique, effectively reducing the risk of dislocation while allowing accurate acetabular cup placement. However, the study is more descriptive in nature. A comparative study with internal fixation will be of use in deciding which surgery is superior. Primary THA provides good functional outcomes and facilitates early ambulation. Results are good in short to midterm outcomes. Long-term outcomes are required to decide the superiority of primary arthroplasty over internal fixation. Therefore, it may be recommended as a primary treatment option for neck of femur fracture in appropriately selected patients.

Conflict of Interest

The authors declare no conflict of interest in this study.

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