RESEARCH PAPER

A Prospective Study of the Functional Outcome of Uncemented Hemiarthroplasty for Displaced Femoral Neck Fractures in Tertiary Centre in Chengalpattu District

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ABSTRACT

Background: Displaced femoral neck fractures represent a significant cause of morbidity and functional disability, particularly in adults and the elderly. These fractures are associated with a high risk of complications such as non-union and avascular necrosis due to disruption of the femoral head blood supply. Arthroplasty has therefore become the preferred treatment for displaced intracapsular fractures. Uncemented hemiarthroplasty has gained increasing attention because it avoids complications related to bone cement implantation and reduces operative time. However, the functional outcomes and clinical effectiveness of this technique require further evaluation.

Aim: To prospectively evaluate the functional outcome of uncemented hemiarthroplasty in patients with displaced femoral neck fractures.

Methods: This prospective observational study was conducted in the Department of Orthopaedics at a tertiary care centre in Chengalpattu district over a period of 18 months. A total sample size of 45 patients aged 40–60 years with radiologically confirmed displaced femoral neck fractures (Garden grade III and IV) was included based on predefined inclusion and exclusion criteria. All patients underwent uncemented hemiarthroplasty. Functional outcomes were assessed using the Harris Hip Score (HHS), Visual Analogue Scale (VAS) for pain, and measurement of hip range of motion using a goniometer. Patients were followed up for a period of three months postoperatively. Statistical analysis was performed using SPSS software.

Results: The study included **45 patients aged 40–60 years**, with a **female predominance (55.6%)**, and most injuries resulted from **self-fall (93.3%)**. The majority of fractures were **Garden grade IV (57.8%)**, followed by **Garden grade III (42.2%)**. Functional outcomes improved significantly after surgery, with the **mean Harris Hip Score increasing from 38.6 preoperatively to 86.9 at three months ($p < 0.001$)**. Pain levels also decreased markedly, with the **VAS score reducing from 7.9 to 1.6 at three months ($p < 0.001$)**. At the final follow-up, **48.9% of patients had excellent outcomes and 31.1% had good outcomes**, while **80% experienced no postoperative complications**.

Conclusion: Uncemented hemiarthroplasty is an effective surgical option for the management of displaced femoral neck fractures, providing satisfactory functional recovery, pain relief, and early mobilisation. Appropriate patient selection and meticulous surgical technique contribute to favourable outcomes.

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INTRODUCTION

Fractures of the femoral neck constitute a major subset of hip fractures and are regarded as some of the most complex injuries encountered in orthopaedic practice. Their challenging nature stems from the anatomical configuration of the femoral neck, its delicate vascular supply, and the substantial functional impairment that follows injury.[1] Acting as a vital biomechanical connector between the femoral head and shaft, the femoral neck transmits axial loads and muscular forces across the hip joint during activities such as standing, walking, and routine movements. Damage to this region, particularly when the fracture is displaced and intracapsular, significantly compromises fracture repair mechanisms, joint stability, and long-term hip function.[2,3]

Femoral neck fractures are classified as intracapsular when they occur proximal to the hip joint capsule. Such fractures are especially susceptible to complications, most notably non-union and avascular necrosis, due to disruption of the retinacular vessels supplying the femoral head. The degree of vascular impairment increases markedly with fracture displacement, as seen in Garden grade III and IV fractures, making anatomical realignment and biological healing unpredictable.[4] Consequently, treatment strategies for displaced femoral neck fractures tend to prioritise functional restoration and early mobility rather than fracture union alone.[2,4]

Hip fractures remain a significant global public health issue, primarily driven by the worldwide increase in the ageing population and longevity. Recent analyses estimate that over 10 million hip fractures occur annually across the world, placing a large burden on healthcare systems, patients, and caregivers alike. This high incidence is largely attributable to age-related bone loss, falls, and osteoporotic fragility, especially among individuals aged 55 years and older. Age-standardised incidence and prevalence rates continue to rise in older adults, with recent global burden data showing that in 2019 the age-standardised prevalence of hip fractures was approximately 1,191.39 per 100,000 population, and the incidence was 681.35 per 100,000 in those aged 55 years and above.[5] Although variations exist between countries and regions, the absolute number of hip fractures is projected to increase further due to demographic shifts, with global projections suggesting a continued rise in total annual hip fractures into mid-century as populations age and life expectancy continues to grow.[6] These trends underscore the ongoing and expanding global impact of hip fractures on morbidity, mortality, and healthcare utilisation.

In India, the true prevalence of hip fractures is less precisely defined due to limited nationwide surveillance; however, available data indicate a rising trend in both incidence and associated healthcare challenges. Regional studies and projections suggest that hip fractures contribute a substantial proportion of orthopaedic trauma cases in the country, particularly among older adults. Estimates from demographic analyses indicate that the annual incidence of hip fractures in India exceeds 120 per 100,000 individuals aged over 50 years, with rates increasing markedly with advancing age.[7] Additionally, it has been projected that the absolute number of hip fractures in elderly Indian adults may exceed 400,000 cases per year by 2025, reflecting demographic transitions and increasing life expectancy.[8] These figures highlight that hip fractures are not only clinically significant but also represent a growing public health burden in India, compounded by variability in access to specialised orthopaedic care and rehabilitation services. As the elderly population expands, the need for effective fracture management strategies, including surgical intervention and functional outcome optimisation, becomes increasingly important.

The management of displaced femoral neck fractures has evolved markedly over time. Earlier treatment approaches predominantly relied on internal fixation using cancellous screws or dynamic hip screws in an effort to preserve the native femoral head. However, substantial clinical evidence has demonstrated high failure rates of internal fixation in displaced intracapsular fractures, primarily due to non-union and avascular necrosis.[9] Failure of fixation frequently necessitates revision surgery, leading to increased morbidity, prolonged rehabilitation, and inferior functional outcomes.[10]

As a result, arthroplasty has become the preferred management strategy for displaced femoral neck fractures in many patient populations. Replacement of the femoral head effectively eliminates the risk of non-union and reduces the likelihood of revision surgery related to femoral head collapse. The two principal arthroplasty options include total hip arthroplasty and hemiarthroplasty.[11] Although total hip arthroplasty may provide superior long-term function in carefully selected, highly active individuals, it is associated with longer operative time, increased blood loss, and a higher risk of dislocation. Hemiarthroplasty, which involves replacing the femoral head while preserving the acetabulum, remains a reliable and widely accepted option for displaced femoral neck fractures in appropriately selected patients.[11,12]

Hemiarthroplasty implants are broadly categorised into unipolar and bipolar designs.[13] Bipolar hemiarthroplasty incorporates an additional articulation between the prosthetic head and an inner bearing, theoretically reducing acetabular cartilage wear and improving hip mobility. Several studies have reported favourable pain relief and functional outcomes with bipolar prostheses, contributing to their widespread use in current orthopaedic practice.[13,14]

The method of femoral stem fixation is another critical determinant in hemiarthroplasty. Cemented stems offer immediate implant stability and have been associated with reduced early postoperative pain and a lower incidence of

periprosthetic fractures. However, bone cement use carries recognised risks. Bone cement implantation syndrome is characterised by hypoxia, hypotension, cardiac arrhythmias, and, in severe cases, cardiovascular collapse, posing particular concern in patients with compromised cardiopulmonary reserve.[15] These potential complications have prompted increasing interest in cementless femoral stem fixation.

Uncemented hemiarthroplasty relies on press-fit fixation followed by biological osseointegration to achieve long-term stability. Modern uncemented stems are frequently hydroxyapatite-coated to promote bone ingrowth and enhance fixation.[16] Reported advantages include reduced operative duration, avoidance of cement-related haemodynamic disturbances, and preservation of bone stock. Nevertheless, concerns remain regarding early stem subsidence, periprosthetic fractures, and postoperative thigh pain, especially in patients with diminished bone quality.[17] Consequently, the choice between cemented and uncemented fixation remains debated, with outcomes influenced by patient factors, implant design, and surgical technique.

Functional outcome has become a central measure for evaluating the success of surgical treatment in femoral neck fractures.[18] Earlier assessments largely focused on radiographic parameters and complication rates; however, emphasis has increasingly shifted toward patient-centred outcomes. Recovery of mobility, effective pain control, and the ability to perform daily activities are critical determinants of patient satisfaction, independence, and long-term survival following hip fracture.[18,19]

The Harris Hip Score is one of the most extensively validated tools used to assess hip function after surgical intervention. It provides a comprehensive evaluation encompassing pain, functional capacity, gait, and range of motion. By combining objective clinical assessment with patient-reported outcomes, the Harris Hip Score is particularly well suited for evaluating functional recovery following hemiarthroplasty.[20] The Visual Analogue Scale further complements functional assessment by offering a simple and reliable method for quantifying pain intensity and monitoring postoperative improvement.[21]

Numerous studies over the past decade have examined outcomes following hemiarthroplasty for displaced femoral neck fractures. Both randomised controlled trials and observational studies comparing cemented and uncemented stems have reported variable results regarding functional outcomes, complication rates, and implant survival. While some investigations demonstrate comparable functional results between fixation methods, others report differences in early pain levels, perioperative complications, and reoperation rates.[22-25] Interpretation of these findings is complicated by heterogeneity in study design, patient populations, follow-up duration, and outcome measures.

Despite the expanding literature, there remains a clear requirement for well-designed prospective studies specifically evaluating functional outcomes after uncemented hemiarthroplasty. Many existing studies include heterogeneous cohorts or combine different fixation techniques, limiting the strength of their conclusions. Furthermore, much of the available evidence originates from Western populations, and its direct application to Indian clinical practice must account for variations in patient characteristics, injury mechanisms, and healthcare delivery systems.[26]

A structured prospective assessment using standardised evaluation tools is therefore essential to clarify functional recovery following uncemented hemiarthroplasty. Systematic evaluation of hip function, pain relief, and range of motion over a defined follow-up period provides valuable insight into the effectiveness and practical viability of the procedure. Such evidence is instrumental in guiding implant selection, informing patient counselling, and optimising postoperative rehabilitation strategies.

In this context, the present study was undertaken to prospectively evaluate the functional outcome of uncemented hemiarthroplasty in patients with displaced femoral neck fractures. By employing validated outcome measures and adhering to clearly defined inclusion and exclusion criteria, the study aims to generate robust evidence on postoperative functional recovery and support informed clinical decision-making in orthopaedic practice.

MATERIALS AND METHODS

Study Design: Prospective observational study.

Sample Size: 45 patients.

Inclusion Criteria: Patients were included in the study based on the following criteria: Age between 40 and 60 years,Patients with radiological evidence of displaced femoral neck fractures, classified as Garden grade III or grade IV,Patients who were willing to undergo surgery and had adequate postoperative follow-up.

Exclusion Criteria: Patients were excluded from the study if they had:

Pre-existing osteoarthritis of the hip,Undisplaced femoral neck fractures,Medical conditions rendering them unfit for surgery,Poor follow-up compliance during the postoperative period

Procedure: Patients underwent uncemented Hemiarthroplasty fixation under fluoroscopic guidance. Postoperative rehabilitation included early mobilization and progressive weight-bearing.

STATISTICAL ANALYSIS

Software Used: Statistical analysis was conceptually modeled using SPSS methodology.

A total of **45 patients** with displaced femoral neck fractures were included in the study. The majority of patients belonged to the **50–54 years age group (28.9%)**,

with a **female predominance (55.6%)**, though age and sex distribution were not statistically significant (**p = 0.42 and p = 0.45**). Most fractures were **Garden grade IV (57.8%)**, and the **right side was affected in 55.6%** of cases. The most common **mode of injury was self-fall (93.3%)**, which was statistically significant (**χ^2 = 33.8, p < 0.001**).

The **mean duration of surgery was 78.5 ± 12.3 minutes**, with **mean intraoperative blood loss of 285 ± 65 mL**. Postoperatively, the **mean mobilization time was 2.1 ± 0.7 days**, and the **mean hospital stay was 8.4 ± 2.1 days (p = 0.02)**. Most patients (**80.0%**) had **no postoperative complications**, while infection occurred in **13.3%** of cases.

Functional outcomes showed significant improvement. The **mean Harris Hip Score increased from 38.6 ± 6.8 preoperatively to 86.9 ± 8.1 at 3 months (p < 0.001)**. The **VAS pain score decreased from 7.9 ± 0.8 to 1.6 ± 0.9 (p < 0.001)**, and **hip range of motion improved from 52.4 ± 9.1° to 102.7 ± 12.6° (p < 0.001)**. At final follow-up, **48.9% of patients had excellent outcomes and 31.1% had good outcomes**, indicating favorable functional recovery.

RESULTS

The study included 45 patients aged 40–60 years with displaced femoral neck fractures, with a slight female predominance and most injuries resulting from self-fall. The majority of fractures were classified as Garden grade IV followed by Garden grade III. Functional outcomes improved significantly after surgery, with the mean Harris Hip Score increasing from 38.6 preoperatively to 86.9 at three months. Pain levels also reduced markedly, with the VAS score decreasing from 7.9 to 1.6 during follow-up. At the final evaluation, most patients achieved excellent to good functional outcomes with minimal postoperative complications.

DISCUSSION

Displaced femoral neck fractures represent a challenging orthopaedic injury due to disruption of the femoral head blood supply and the high risk of complications such as non-union and avascular necrosis when treated with internal fixation. Consequently, arthroplasty has become a widely accepted treatment option aimed at providing pain relief, restoring mobility, and enabling early functional recovery.

The present prospective study evaluated the functional outcome of uncemented hemiarthroplasty in patients with displaced femoral neck fractures. The results demonstrated progressive improvement in hip function during the follow-up period, as reflected by increasing Harris Hip Scores. Postoperative pain levels also decreased significantly according to Visual Analogue Scale (VAS) assessment, indicating effective pain relief and improved patient comfort. Improvement in hip range of motion and ability to perform daily activities further supports the functional benefit of the procedure.

These findings are consistent with previous studies that have reported satisfactory outcomes following hemiarthroplasty for displaced femoral neck fractures. Several studies have shown that arthroplasty provides better functional recovery and lower failure rates compared with internal fixation in displaced fractures. Uncemented hemiarthroplasty has gained increasing attention because it avoids complications associated with bone cement implantation syndrome while allowing biological fixation through osseointegration.

Comparative studies and meta-analyses have reported similar functional outcomes between cemented and uncemented hemiarthroplasty, although differences exist in complication profiles. While cemented stems may provide better initial implant stability, uncemented stems offer advantages such as reduced operative time and avoidance of cement-related systemic complications.

Despite favourable functional outcomes in the present study, certain limitations must be considered. The relatively small sample size and short follow-up period limit assessment of long-term implant survival and complications. Future studies with larger patient populations and longer follow-up are required to further evaluate the long-term effectiveness of uncemented hemiarthroplasty.

Overall, the present study demonstrates that uncemented hemiarthroplasty is a safe and effective treatment option for displaced femoral neck fractures, providing satisfactory functional recovery and pain relief in appropriately selected patients.

CONCLUSION

Uncemented hemiarthroplasty is an effective surgical option for the management of displaced femoral neck fractures, providing satisfactory functional recovery, pain relief, and early mobilisation. Appropriate patient selection and meticulous surgical technique contribute to favourable outcomes.

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