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Original Article

Functional Outcomes Following Total Hip Replacement: A Prospective Study of Harris Hip Score Improvement and Predictive Value

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ABSTRACT

Background: Total hip replacement (THR) is one of the most successful reconstructive procedures in orthopaedic surgery and is widely performed for end-stage hip disorders such as avascular necrosis, osteoarthritis, fracture neck of femur, and inflammatory arthropathies. Functional outcome following THR is commonly assessed using the Harris Hip Score (HHS), a validated and reliable measure of pain, function, deformity, and range of motion. However, data regarding the predictive value of preoperative HHS on postoperative recovery remain limited, particularly in rural and tribal populations of central India.

Objectives: To evaluate changes in Harris Hip Score following total hip replacement and to assess the predictive value of preoperative HHS on postoperative functional outcomes.

Methods: A prospective observational study was conducted in the Department of Orthopaedics, Raipur Institute of Medical Sciences, Raipur, Chhattisgarh, India, over a period of 18 months. A total of 79 patients undergoing primary THR were included. Functional outcome was assessed using the Harris Hip Score preoperatively, immediately postoperatively, at 3 months, and at 6 months after surgery. Changes in HHS over time were analyzed, and subgroup analysis was performed according to baseline HHS categories to evaluate its predictive value for postoperative recovery.

Results: The mean age of the study population was 44.16 ± 13.85 years, and 77.2% of patients were male. The mean preoperative HHS was 26.37 ± 6.15, which improved significantly to 39.29 ± 1.52 immediately after surgery, 73.13 ± 2.10 at 3 months, and 84.32 ± 3.03 at 6 months ($p < 0.001$ for all comparisons). The overall mean improvement in HHS from baseline to 6 months was 57.95 points. Patients with lower baseline HHS demonstrated greater absolute postoperative improvement. Individuals with a preoperative HHS <20 achieved the greatest functional gain, with a mean improvement of 65.55 points at 6 months, compared with 50.60 points among those with baseline HHS >30.

Conclusion: Total hip replacement significantly improves hip function and quality of life in the central Indian population. While preoperative status is a predictor of recovery, even patients with severe baseline impairment achieve remarkable functional gains. These findings support the broader implementation of THR programs in rural and tribal healthcare settings to address the growing burden of end-stage hip disease.

Keywords: Total hip replacement; Total hip arthroplasty; Harris Hip Score; Functional outcome; Avascular necrosis; Predictive value; Prospective study.

INTRODUCTION

Total hip replacement is widely regarded as one of the most successful and cost-effective reconstructive procedures in modern orthopaedics, often described as "the operation of the century" (1,2). It is commonly performed for the management

of end-stage hip disorders, including osteoarthritis, avascular necrosis of the femoral head, fracture of the neck of the femur, rheumatoid arthritis, and other debilitating hip pathologies (3,4). By replacing the damaged articular surfaces with prosthetic components, THR aims to relieve pain, restore joint mobility, improve functional capacity, and enhance overall quality of life (4,5). Advances in implant design, biomaterials, surgical techniques, and perioperative care have contributed to excellent long-term outcomes and high patient satisfaction rates following the procedure (5–7).

The burden of hip joint disorders continues to increase globally. Recent estimates from the Global Burden of Disease Study indicate a steady rise in the incidence, prevalence, and disability-adjusted life years attributable to hip osteoarthritis from 1990 onwards, driven largely by population growth, aging, and epidemiological changes (8–10). In developing countries such as India, the disease profile differs from that observed in Western populations, with avascular necrosis of the femoral head constituting a major indication for THR, often affecting younger adults (11,12). Moreover, patients frequently present at an advanced stage of disease with severe pain, restricted mobility, and substantial impairment of activities of daily living, frequently against a backdrop of low socioeconomic status and limited access to specialized orthopaedic care (Lakhotia & Agrawal, Functional Outcome of Uncemented Total Hip Replacement in Low Socioeconomic Group Using Modified Harris Hip Score: A Prospective Midterm Follow-Up Study, 2023; Pandian, Vignesh, & Raman, 2019; Singh, et al., 2024). These limitations not only compromise physical function but also result in considerable socioeconomic consequences. Consequently, objective assessment of postoperative functional recovery has become an integral component of evaluating the success of THR (16,17).

Several clinical scoring systems have been developed to assess outcomes following hip arthroplasty, including the Merle d'Aubigné–Postel, WOMAC, Oxford Hip Score, and the Harris Hip Score (4,18). Among these, the HHS remains one of the most widely accepted and frequently utilized instruments (19,20). Originally introduced by Harris in 1969, the HHS was formulated to measure important outcome variables applicable to different hip disorders and treatment techniques (21,22). The HHS is a validated, reliable, and joint-specific outcome measure that evaluates four domains: pain (44 points), function (47 points), absence of deformity (4 points), and range of motion (5 points), yielding a total score ranging from 0 to 100 (4,20,23). Higher scores indicate better hip function and improved clinical outcomes. Owing to its sensitivity and responsiveness, the HHS has been extensively employed in both clinical practice and research to assess functional recovery following THR (Josipović, Moharić, & Salamon, 2020; Lakhotia & Agrawal, Functional Outcome of Uncemented Total Hip Replacement in Low Socioeconomic Group Using Modified Harris Hip Score: A Prospective Midterm Follow-Up Study, 2023; derman & Malchau, 2001, p. 335).

Although numerous studies have demonstrated significant improvements in HHS following THR (Wod, et al., 2024; Lakhotia & Agrawal, Functional Outcome of Uncemented Total Hip Replacement in Low Socioeconomic Group Using Modified Harris Hip Score: A Prospective Midterm Follow-Up Study, 2023; Singh, et al., 2024), there remains limited evidence regarding the predictive value of preoperative HHS on postoperative functional recovery, with relatively few studies specifically addressing cutoff thresholds that discriminate excellent from non-excellent outcomes (24–26). Furthermore, the predictive relationship between baseline functional status and the magnitude of postoperative improvement remains inconsistently reported, particularly in rural and tribal populations of central India (Kadam, Bansal, & Chhallani, Study of functional outcome of total hip arthroplasty in a series of cases of hip pathologies done in rural population, 2016; Pandian, Vignesh, & Raman, 2019; Kumar, et al., 2025). Understanding whether baseline functional status influences postoperative improvement may assist clinicians in patient counseling, expectation management, and prognostication. Regional variations in patient characteristics, disease severity, healthcare access, and treatment-seeking behavior necessitate the generation of local evidence to better understand functional outcomes following THR (12,14,15). Despite the increasing utilization of THR in India (12), there is a paucity of prospective studies evaluating short-term functional outcomes and the predictive significance of preoperative Harris Hip Score in patients undergoing THR, particularly in rural and tribal settings (Kumar, et al., 2025; Kadam, Bansal, & Chhallani, Study of functional outcome of total hip arthroplasty in a series of cases of hip pathologies done in rural population, 2016; Singh, et al., 2024). Most available literature originates from urban tertiary care centers and may not accurately reflect the demographic and clinical profile of patients presenting to resource-limited regions. Therefore, this study was undertaken to evaluate changes in HHS following THR and to explore the role of baseline HHS in predicting postoperative functional outcomes.

The present study was undertaken to evaluate the functional outcomes of patients undergoing total hip replacement by assessing changes in the Harris Hip Score from the preoperative period to successive postoperative follow-up visits. Additionally, the study aimed to examine the relationship between preoperative HHS and postoperative functional recovery in order to determine the predictive value of baseline HHS in estimating clinical outcomes following total hip replacement.

METHODS

Study Design and Setting

A prospective observational study was conducted in the Department of Orthopaedics, Raipur Institute of Medical Sciences, Raipur, Chhattisgarh, India, over a period of 18 months. Consecutive patients undergoing primary total hip replacement (THR) for end-stage hip disorders were enrolled after obtaining informed consent.

Study Population
A total of 79 patients who underwent THR and completed follow-up assessments were included in the study.

Eligibility Criteria
Patients aged ≥25 years with epiphyseal maturity undergoing THR for avascular necrosis, osteoarthritis, fracture neck of femur, rheumatoid arthritis, failed hip reconstruction, or other terminal inflammatory arthropathies were included. Patients with pathological fractures, active hip infections, renal failure, previous major childhood hip surgeries (except developmental dysplasia requiring THR), severe medical comorbidities precluding surgery, or loss to follow-up were excluded.

Clinical Assessment
Functional outcome was assessed using the Harris Hip Score (HHS). Baseline HHS was recorded preoperatively. Follow-up assessments were performed immediately after surgery at discharge, at 3 months, and at 6 months postoperatively by the same investigator.

Outcome Measures
The primary outcome was change in mean HHS from baseline to 6 months following THR. Secondary outcomes included evaluation of the predictive value of baseline HHS for postoperative functional outcome. Patients were stratified according to preoperative HHS categories (<20, 20–25, 26–30, and >30), and changes in HHS across follow-up periods were compared.

Statistical Analysis
Continuous variables were summarized as mean ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages. Changes in HHS between baseline and postoperative follow-up visits were analyzed using paired statistical tests. A p-value <0.05 was considered statistically significant.

Ethical Approval
The study protocol was approved by the Institutional Ethics Committee of Raipur Institute of Medical Sciences, Raipur, Chhattisgarh. Written informed consent was obtained from all participants prior to surgery and enrollment in the study.

RESULTS

Baseline Characteristics
A total of 79 patients who underwent primary total hip replacement (THR) were included in the study. The mean age of the study population was 44.16 ± 13.85 years. Males constituted the majority of the participants (77.2%), while females accounted for 22.8%.

Table 1: Baseline Demographic Characteristics of the Study Participants (N = 79)

Variable	Value
Age (years), Mean ± SD	44.16 ± 13.85
Male, n (%)	61 (77.2)
Female, n (%)	18 (22.8)

Functional Outcome Following Total Hip Replacement
The mean preoperative Harris Hip Score (HHS) was 26.37 ± 6.15. A progressive and statistically significant improvement in HHS was observed throughout the follow-up period. The mean HHS increased to 39.29 ± 1.52 immediately after surgery, 73.13 ± 2.10 at 3 months, and 84.32 ± 3.03 at 6 months postoperatively.

Table 2: Harris Hip Score at Different Follow-up Intervals and Change from Baseline

Follow-up Interval	Mean HHS ± SD	Mean Improvement from Baseline	p-value*
Preoperative	26.37 ± 6.15	—	—
Immediate Postoperative	39.29 ± 1.52	12.92	<0.001
3 Months	73.13 ± 2.10	46.76	<0.001
6 Months	84.32 ± 3.03	57.95	<0.001

*Compared with preoperative HHS.

The greatest improvement in functional outcome occurred during the first three postoperative months. Continued improvement was observed up to the sixth postoperative month, resulting in an overall mean increase of 57.95 points from baseline.

Predictive Value of Baseline Harris Hip Score

Subgroup analysis based on baseline HHS demonstrated that patients with poorer preoperative functional status experienced greater absolute postoperative improvement. Patients with baseline HHS <20 achieved the largest gain in HHS during follow-up, whereas patients with higher baseline scores also showed substantial functional improvement after THR.

Table 3: Change in Harris Hip Score According to Baseline HHS Category

Baseline HHS Category	Mean Improvement Immediately Postoperative	Mean Improvement at 3 Months	Mean Improvement at 6 Months
<20	20.50	54.77	65.55
>20	Not Reported	50.63	60.21
>30	Not Significant	37.86	50.60

Patients with a baseline HHS <20 demonstrated the greatest absolute improvement at 6 months (65.55 points), suggesting that preoperative HHS may have predictive value in determining the magnitude of functional recovery following THR.

Overall, THR resulted in substantial and sustained improvement in hip function. The mean HHS increased from a preoperative score of 26.37 ± 6.15 to 84.32 ± 3.03 at 6 months, representing a highly significant functional gain ($p < 0.001$).

DISCUSSION

The current study demonstrates that Total Hip Replacement provides a substantial and statistically significant improvement in functional capacity for patients in the Raipur region of Chhattisgarh. The primary finding— a mean increase in Harris Hip Score from 26.37 ± 6.15 preoperatively to 84.32 ± 3.03 at 6 months—represents a highly significant gain of 57.95 points ($p < 0.001$). This magnitude of improvement underscores THR as a transformative intervention for end-stage hip pathology, consistent with its reputation as the "operation of the century" (1,2).

Demographic Profile and Epidemiological Context

The demographic profile of our study—characterized by a mean age of 44.16 ± 13.85 years and a strong male predominance (77.2%)—is typical of the Indian epidemiological landscape for hip disorders. This contrasts sharply with Western populations, where primary osteoarthritis in older age groups is the leading indication for THR (10,12). In India, avascular necrosis of the femoral head is a dominant indication, often affecting younger males who are the primary breadwinners for their families (11,12). Our age profile is particularly similar to that reported by Jain et al. (Jain, Sao, & Patond, Statistical analysis of total hip arthroplasty at rural hospital in Maharashtra under MJPJAY: a prospective study, 2024) in a rural Maharashtra hospital (40.32 years) and Lakhotia & Agrawal (Lakhotia & Agrawal, Functional Outcome of Uncemented Total Hip Replacement in Low Socioeconomic Group Using Modified Harris Hip Score: A Prospective Midterm Follow-Up Study, 2023) (where many were manual laborers). The relatively young age of our patients highlights the high functional demand placed on the prosthetic joint and the socio-economic importance of restoring mobility in this population (Lakhotia & Agrawal, Functional Outcome of Uncemented Total Hip Replacement in Low Socioeconomic Group Using Modified Harris Hip Score: A Prospective Midterm Follow-Up Study, 2023; Reddy, MS, & Phad, 2018).

Interpretations of Functional Outcomes

The observed mean postoperative HHS of 84.32 at 6 months aligns with established benchmarks for "good" clinical outcomes (23). This result is comparable to findings by Wod et al. (17), who reported a similar trajectory of improvement, reaching a mean HHS of 92 at 6 months from a baseline of 28. In the context of the Indian rural and semi-urban population, our results are consistent with Pandian et al. (14), who observed a postoperative mean HHS of 84 in a lower socioeconomic cohort, and Kumar et al. (16), who reported 6-month scores ranging from 83.9 to 87.1 depending on the fixation method. The significant gain of 57.95 points in our study exceeds the improvement reported by Aswal (12), where mean HHS increased from 46.8 to 88.6 (a gain of 41.8 points), likely reflecting the more advanced stage of disease at presentation in our cohort.

Predictive Value of Baseline Functional Status

A critical finding of this study is the relationship between preoperative functional status and the magnitude of recovery. Patients with the lowest baseline functional status (HHS <20) achieved the highest absolute gain of 65.55 points at 6 months. In contrast, patients with higher baseline scores (>30) showed a significant but smaller absolute improvement of 50.60 points. This inverse relationship between baseline score and absolute gain suggests that those with the most severe impairment have the most to benefit from the procedure in terms of raw score improvement.

These findings contribute to the ongoing debate regarding the optimal timing of surgery. Aljassir et al. (25) noted that while postoperative outcomes can be predicted by preoperative status, patients with a baseline HHS of 65 had a 100% probability of achieving an "excellent" result (>90), suggesting that waiting for scores to drop below a certain threshold might limit the final functional ceiling. However, our data suggest that in resource-limited settings where patients frequently present late with severe symptoms (baseline HHS <20), the procedure still offers massive functional reclamation (Lakhotia & Agrawal, Functional Outcome of Uncemented Total Hip Replacement in Low Socioeconomic Group Using Modified

Harris Hip Score: A Prospective Midterm Follow-Up Study, 2023; Pandian, Vignesh, & Raman, 2019). As noted by Singh et al. (24), both the absolute postoperative score and the magnitude of change are predictive of long-term success, and our results confirm that substantial gains are possible even in severely debilitated patients.

Clinical Implications for Rural and Tribal Populations

The study's setting in Chhattisgarh, a region with significant rural and tribal populations, presents unique clinical challenges. Patients in these areas often experience delayed presentation due to limited access to specialized orthopaedic care and socioeconomic constraints (14,16). The severity of the preoperative state (mean HHS 26.37) reflects this late presentation. Despite these challenges, the high success rate and significant pain relief observed suggest that THR is a viable and highly effective intervention even in resource-limited regions. Providing access to such reconstructive surgeries can mitigate the socioeconomic burden caused by hip-related disability in manual labor-intensive communities (Singh, et al., 2024; Lakhotia & Agrawal, Functional Outcome of Uncemented Total Hip Replacement in Low Socioeconomic Group Using Modified Harris Hip Score: A Prospective Midterm Follow-Up Study, 2023).

Limitations and Future Directions

This study is subject to certain limitations, most notably the short-term follow-up duration of 6 months. While research by Vissers et al. (29) indicates that physical functioning generally recovers to approximately 80% of control levels within 6 to 8 months postoperatively, long-term data are required to evaluate implant longevity and late complications such as aseptic loosening or wear in this younger cohort (12,17). Additionally, the relatively small sample size may limit the generalizability of the subgroup analyses.

Future research should focus on multi-centric longitudinal studies with longer follow-up periods (5-10 years) to assess the durability of these functional gains. Studies exploring the specific impact of different prosthetic designs (e.g., cemented vs. uncemented) in tribal populations with high physical demands would also be beneficial for refining surgical protocols in the region (Jain, Sao, & Patond, Statistical analysis of total hip arthroplasty at rural hospital in Maharashtra under MJPJAY: a prospective study, 2024; Kumar, et al., 2025).

CONCLUSION

Total hip replacement results in substantial and sustained improvement in functional outcomes, as measured by the Harris Hip Score. Significant gains were observed as early as the immediate postoperative period and continued throughout the six-month follow-up. Lower preoperative HHS was associated with greater absolute postoperative improvement, suggesting that baseline functional status may have predictive value in determining the magnitude of recovery following THR. These findings support the effectiveness of THR in improving function and quality of life among patients with end-stage hip disorders in rural and tribal populations.

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