



Original Article

Retrospective Study of Functional and Radiological Outcomes of Total Hip Arthroplasty

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ABSTRACT

Background: Total hip arthroplasty (THA) is an established treatment for end-stage hip disorders, providing pain relief and restoration of function. This retrospective study evaluated functional and radiological outcomes of primary THA performed at a tertiary-care centre in Bikaner, Rajasthan.

Methods: Medical records and follow-up radiographs of 78 patients who underwent primary THA between January 2023 and December 2025 were retrospectively reviewed. Functional outcome was assessed using the Modified Harris Hip Score (MHHS) and pain using the visual analogue scale (VAS). Radiological assessment included acetabular inclination, femoral stem alignment, radiolucent lines, migration, osteolysis, heterotopic ossification and evidence of loosening, using DeLee–Charnley and Gruen zones where applicable. Follow-up was performed at 6 weeks, 3 months, 6 months, 1 year and subsequently at yearly intervals; minimum follow-up was 6 months and maximum was 42 months.

Results: The mean age was 48.5 years and 67.95% of patients were male. Avascular necrosis was the commonest indication (61.54%). Uncemented fixation was used in 87.18%, cemented fixation in 8.97% and hybrid fixation in 3.85%. Mean MHHS improved from 38.63 ± 5.40 preoperatively to 83.93 ± 10.93 at the overall final available follow-up ($p < 0.001$); the 3-year subgroup reached 87.93 ± 2.46 . Mean VAS decreased from 7.29 ± 0.99 to 0.56 ± 0.66 in the overall preoperative-versus-final comparison ($p < 0.001$), while the 3-year subgroup had a mean VAS of 0.13. At 3 years, 83.33% of stems were neutrally aligned and 89.74% of acetabular components were within the reported Lewinnek safe zone. No aseptic loosening was observed during the available follow-up. Overall complications were reported in 10.24%, with dislocation being the most frequent (3.84%).

Conclusion: Primary THA provided marked pain relief, functional improvement and satisfactory radiological fixation in this institutional cohort. Uncemented THA predominated in the younger, predominantly AVN population, while cemented fixation provided better early functional recovery but comparable later scores in the reported subgroup analysis. Longer multicentre follow-up is required to assess long-term survivorship and late wear-related complications.

Keywords: Total hip arthroplasty; total hip replacement; Modified Harris Hip Score; avascular necrosis; radiological outcome; uncemented THA; cemented THA.

INTRODUCTION

The hip is a major weight-bearing joint responsible for mobility, stability, posture and locomotion. Advanced hip disease may cause pain, stiffness, deformity, limb-length discrepancy and progressive restriction of activities of daily living. Common indications for THA include osteoarthritis, osteonecrosis of the femoral head, inflammatory arthropathies, post-traumatic arthritis, fracture sequelae and other destructive hip disorders.

Total hip arthroplasty has evolved substantially since the early designs of Wiles and the subsequent development of the McKee–Farrar and Charnley low-friction concepts. Contemporary implants may be cemented, uncemented or hybrid, with implant selection influenced by age, bone quality, activity level, anatomy and surgeon preference. Uncemented components achieve biological fixation through osseointegration, whereas cemented components provide immediate mechanical fixation.[3–6]

The epidemiology of THA in India differs from many Western populations. The thesis literature review notes that osteonecrosis of the femoral head constitutes a major indication for THA in Indian patients, often affecting a younger and more active population. Assessment of THA therefore requires both functional and radiological evaluation. The MHHS provides a practical measure of pain and function, while serial radiographs permit assessment of component alignment, fixation, migration, radiolucent lines, osteolysis and heterotopic ossification.[9,10,13–16,20]

The choice of fixation is an important component of preoperative planning. Cemented fixation relies on a cement mantle to provide immediate mechanical stability, whereas uncemented implants depend on initial press-fit stability followed by bone ingrowth. These approaches should not be viewed as universally interchangeable; the decision is influenced by patient age, bone quality, femoral morphology, activity demands and the surgeon's assessment of the individual hip. In a cohort with a relatively young mean age and a high proportion of osteonecrosis, documenting the fixation strategy alongside serial clinical and radiological findings is particularly relevant.

Functional assessment after THA should capture both pain relief and the ability to resume everyday activities. The Modified Harris Hip Score combines pain and functional domains with examination-related components and provides a commonly used outcome measure in clinical studies. However, a score should be interpreted together with the patient's walking ability, need for an assistive device and residual symptoms. The visual analogue scale complements the MHHS by quantifying pain intensity, allowing the postoperative course to be described from both a functional and a symptom-based perspective. Radiological surveillance provides a separate but complementary assessment of the reconstruction. Acetabular inclination and femoral stem alignment help describe component position, while radiolucent lines, migration, osteolysis and heterotopic ossification may indicate changes that warrant continued observation. The DeLee–Charnley and Gruen zonal systems offer a structured way to report findings around the acetabular and femoral components, respectively. A lack of radiographic loosening during short- or mid-term follow-up is reassuring, but does not establish long-term implant survival, particularly because wear-related changes and osteolysis may develop over a longer period.

Local outcome data are useful because patient characteristics, underlying diagnoses, implant selection and follow-up patterns vary between institutions. A retrospective evaluation from a tertiary-care centre can describe the case mix encountered in routine practice and identify the extent of functional improvement and early complications observed in that setting. The present study therefore assessed clinical scores, pain, mobility, component position and recorded complications following primary THA at Sardar Patel Medical College and Associated Group of Hospitals, Bikaner. The findings are interpreted as outcomes of this institutional cohort rather than as proof that one fixation method is superior to another.

The present study was undertaken to evaluate functional and radiological outcomes following primary THA at Sardar Patel Medical College and Associated Group of Hospitals, Bikaner, over the period January 2023 to December 2025.

Aim and Objectives

Aim: To evaluate the functional and radiological outcomes of primary total hip arthroplasty performed at S.P. Medical College, Bikaner.

Objectives-

1. To assess functional outcome using the Modified Harris Hip Score.
2. To evaluate radiological outcome including implant position, fixation, loosening and migration.
3. To compare outcomes between cemented and uncemented THA.
4. To correlate outcomes with indications such as osteoarthritis, avascular necrosis and rheumatoid arthritis.
5. To document intraoperative and postoperative complications and assess implant survivorship during follow-up.

MATERIALS AND METHODS

Study design and setting: This was a retrospective observational study conducted in the Department of Orthopaedics, Sardar Patel Medical College and Associated Group of Hospitals, Bikaner, Rajasthan. The study period was January 2023 to December 2025.

Study population: A total of 78 patients who underwent primary THA and fulfilled the study criteria were included. The thesis records inclusion of patients aged 20–80 years with diagnoses including osteoarthritis, avascular necrosis, rheumatoid arthritis, tuberculosis hip or post-traumatic arthritis, provided at least 6 months of clinical and radiological follow-up was available. Revision THA, incomplete records, loss to follow-up before 6 months, active infection and malignancy involving the hip were excluded.

Clinical assessment: Demographic and clinical information, diagnosis, side, symptom duration, comorbidities, preoperative pain, limp, deformity, limb-length discrepancy and range of motion were retrieved. Functional status was assessed using the MHHS. Pain was recorded using VAS. Patients were reviewed at 6 weeks, 3 months, 6 months, 1 year and yearly thereafter, with the longest reported follow-up being 42 months.

Surgical and implant assessment: The posterior approach was used in 98.72% of cases. Fixation was uncemented in 68 patients (87.18%), cemented in 7 (8.97%) and hybrid in 3 (3.85%). The thesis reports a predominantly uncemented strategy in younger patients with Dorr A/B bone, while cemented fixation was used more commonly in elderly patients with poorer bone quality.

Radiological assessment: Standard anteroposterior pelvic radiographs including both hips and the proximal femur were evaluated. Acetabular inclination, cup position, femoral stem alignment, radiolucent lines, migration, osteolysis, loosening, limb-length discrepancy and heterotopic ossification were assessed. DeLee–Charnley zones were used for acetabular assessment and Gruen zones for femoral evaluation. The thesis reports the Lewinnek safe zone for acetabular component position.

The demographic profile shows that the cohort was predominantly male and middle-aged, with avascular necrosis accounting for the largest share of indications. This distribution is relevant when interpreting the results because the underlying diagnosis and age profile may influence both implant choice and expected activity after surgery. Advanced radiographic changes were common in the applicable subgroup, while the three patients with fresh traumatic fractures were not included in MHHS and Kellgren–Lawrence grading because these measures were not considered applicable to their acute presentation.

The preoperative clinical burden was substantial: more than two-thirds of patients had an antalgic limp, nearly one-third required ambulatory support, and the mean pain and functional scores reflected marked symptoms before surgery. These baseline findings provide context for the magnitude of change observed during follow-up. They also indicate that postoperative assessment should not rely on score changes alone; mobility, residual limp and occasional pain remain relevant clinical outcomes.

Statistical analysis: The thesis used descriptive and inferential statistical methods. A p value <0.05 was considered statistically significant. The paired preoperative-versus-final comparison reported in the thesis showed a highly significant improvement in MHHS and VAS.

The posterior approach was used in 98.72% of procedures, making it the dominant surgical approach in this series. Uncemented fixation accounted for the large majority of implants (68/78), while the cemented and hybrid groups contained seven and three patients, respectively. Mean operative duration was 117.5 minutes, mean estimated blood loss was 199.80 mL and mean hospital stay was 8.97 days. These values describe the operative and immediate inpatient course in this

centre; comparisons with other series should account for differences in case mix, perioperative protocols and definitions used for recording these measures.

RESULTS

The serial scores demonstrate a progressive improvement over the recorded follow-up intervals. Mean MHHS increased from 38.63 preoperatively to 62.31 at 6 weeks, 72.63 at 3 months and 80.96 at 6 months, with further improvement to 83.38 at 1 year, 85.54 at 2 years and 87.93 in the 3-year subgroup. In parallel, mean VAS decreased from 7.29 before surgery to 2.82 at 6 weeks and 1.65 at 3 months, reaching 0.92 at 6 months and 0.13 in the 3-year subgroup. The overall paired analysis showed a mean MHHS gain of 45.31 points and a 6.71-point reduction in VAS; both comparisons were statistically significant ($p < 0.001$).

The overall paired final assessment (MHHS 83.93 ± 10.93 ; VAS 0.56 ± 0.66) and the separately reported 3-year subgroup values should be read as different summaries rather than as interchangeable estimates, because the available follow-up duration varied across patients. At final follow-up, 76 patients were walking without support and two were recorded as bedridden. Persistent limp was reported in five patients, including three with contralateral AVN, and ten patients reported mild occasional pain after long walks. These residual symptoms qualify the overall improvement and highlight the importance of considering the contralateral hip and activity-related discomfort during follow-up.

Demographic and clinical profile

The study included 78 patients with a mean age of 48.5 years. Males constituted 67.95% of the cohort. Avascular necrosis was the predominant indication, accounting for 61.54% of cases. The thesis also describes a substantial burden of advanced disease at presentation, with Kellgren–Lawrence grade III/IV changes reported in 88% of the applicable radiographic subgroup. Three bedridden patients with fresh traumatic fractures were excluded from MHHS and Kellgren–Lawrence grading because these measures were not applicable in the acute setting.

Preoperatively, 70.51% of patients had an antalgic limp and 30.77% required ambulatory support. The mean preoperative VAS was 7.29 ± 0.99 and mean MHHS was 38.63 ± 5.40 , indicating severe pain and poor functional status.

Surgical parameters and fixation

Fixation	Patients	Percentage
Uncemented	68	87.18%
Cemented	7	8.97%
Hybrid	3	3.85%
Total	78	100%

Mean operative duration was 117.5 minutes and mean estimated blood loss was 199.80 mL. Mean hospital stay was 8.97 days. The predominant posterior approach and uncemented fixation reflected the characteristics of the study population and institutional practice.

Functional outcome

The fixation subgroup results showed a higher mean MHHS in the cemented group at 6 weeks, while the mean scores were closer across groups from 3 months onward. The reported difference was no longer statistically significant from 6 months onward ($p > 0.05$). This pattern is descriptive and should not be interpreted as definitive comparative effectiveness: only seven patients received cemented fixation and three received hybrid fixation, compared with 68 in the uncemented group. The unequal group sizes and small numbers limit statistical power and make the subgroup estimates vulnerable to individual-patient variation.

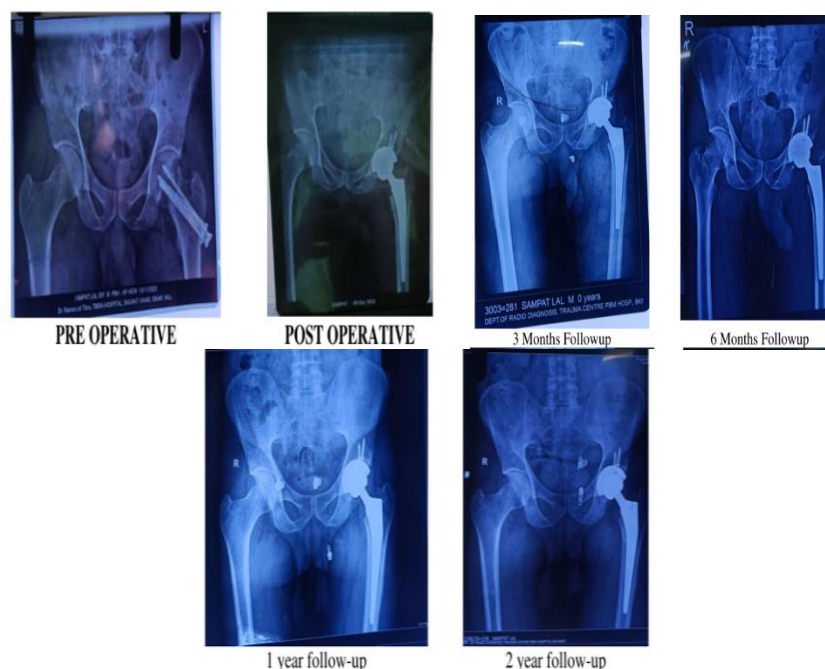
Follow-up	MHHS (mean $\pm$ SD)	VAS (mean $\pm$ SD)
Preoperative	38.63 ± 5.40	7.29 ± 0.99
6 weeks	62.31 ± 9.55	2.82 ± 1.26
3 months	72.63 ± 10.20	1.65 ± 1.02
6 months	80.96 ± 10.15	0.92 ± 0.86
1 year	83.38 ± 11.85	0.55 ± 0.68
2 years	85.54 ± 5.22	0.43 ± 0.55
3 years	87.93 ± 2.46	0.13 ± 0.36

The overall paired comparison reported in the thesis showed MHHS improvement from 38.63 ± 5.40 to 83.93 ± 10.93 , with a mean gain of 45.31 points ($t=32.11$, $p<0.001$). VAS decreased by 6.71 points, from 7.29 ± 0.99 to 0.56 ± 0.66 ($t=-45.32$, $p<0.001$). The thesis separately reports a 3-year subgroup MHHS of 87.93 ± 2.46 and VAS of 0.13 ± 0.36 .

Neutral femoral stem alignment was documented in 83.33% of cases, while 89.74% of acetabular components were reported within the Lewinnek safe zone. No aseptic loosening was identified during the available follow-up. One asymptomatic Brooker grade II heterotopic ossification and one limb-length discrepancy greater than 1.5 cm were recorded. These findings support satisfactory early-to-mid-term radiographic observations in the cohort, but the variable follow-up period, extending to 42 months, does not allow conclusions about long-term fixation durability or late osteolysis.

At final follow-up, 76 patients (97.44%) were ambulatory without support and 2 patients (2.56%) were bedridden. Persistent limping was reported in 5 patients (6.41%); 3 of these had contralateral AVN. Mild occasional pain after long walks was reported by 10 patients (12.82%).

Dislocation was the most frequently reported complication, occurring in 3.84% of patients, within an overall recorded complication rate of 10.24%. Other documented events included heterotopic ossification and limb-length discrepancy. The study records reported no deep infection, no aseptic loosening and no revision for aseptic loosening during the available follow-up. The absence of these events in this series should be interpreted in the context of its sample size and follow-up duration and should not be taken to indicate that such complications cannot occur.



Comparison of fixation groups

Time point	Uncemented MHHS	Cemented MHHS	Hybrid MHHS
Preoperative	38.64	39.57	36.00
6 weeks	58.55	65.14	62.33
3 months	73.85	72.28	73.66
6 months	82.33	81.28	80.67
1 year	85.11	83.80	82.50
2 years	85.97	84.10	—
3 years	88.21	85.20	—

The cemented group had a statistically higher MHHS at 6 weeks (65.14 vs 58.55 ; $p<0.001$). According to the thesis, this early difference was attributed to immediate mechanical fixation. By 6 months and thereafter, the reported difference was no longer statistically significant ($p>0.05$). Because the cemented and hybrid groups were small, these subgroup comparisons should be interpreted cautiously.

Radiological outcome

Radiographs demonstrated satisfactory component positioning and fixation during the available follow-up. Neutral femoral stem alignment was present in 83.33% of cases, and 89.74% of acetabular components were reported to lie within the Lewinnek safe zone. No aseptic loosening was identified during the mid-term follow-up. The thesis also reports one asymptomatic Brooker grade II heterotopic ossification (1.28%) and one patient with limb-length discrepancy greater than 1.5 cm. The available records did not demonstrate catastrophic implant failure.

The photographic/radiographic supplement supplied with the thesis includes preoperative and postoperative radiographs, serial follow-up images, clinical functional photographs, and examples of complications including dislocation after closed reduction, heterotopic ossification and osteolysis in Gruen zone 1.

Complications

The overall complication rate was 10.24%. Dislocation was the most common reported early complication, occurring in 3.84% of patients. Other reported complications included heterotopic ossification and limb-length discrepancy. The thesis states that there was no deep infection, no aseptic loosening and no revision for aseptic loosening during the available follow-up.



DISCUSSION

The present retrospective series demonstrates substantial improvement in pain and hip function following primary THA. The mean MHHS increased from 38.63 preoperatively to 83.93 in the overall paired final comparison, while the 3-year subgroup reached 87.93. The magnitude of improvement is clinically important and is consistent with the broad evidence summarized in the thesis, in which Indian studies have generally shown marked postoperative gains in Harris or Modified Harris Hip Scores.[11–19,21–23]

The predominance of AVN in the present cohort is noteworthy. AVN accounted for 61.54% of cases, reflecting the younger age profile of many Indian THA populations. The thesis review cites Indian studies in which AVN is a major indication

and describes the contrast with Western cohorts in which primary osteoarthritis predominates. This epidemiological pattern is important when interpreting implant selection and expected survivorship.[9,10,13–16,20]

Uncemented fixation was used in 87.18% of the present series. This is consistent with the thesis rationale that younger patients with good Dorr A/B bone stock are suitable for biological fixation. The cemented subgroup demonstrated superior early MHHS at 6 weeks, but the difference disappeared later. This finding supports the practical concept that cemented fixation may facilitate early stability, whereas successful osseointegration of uncemented components can provide comparable medium-term function.. [7,8,13–16]

Radiological outcomes were favourable. Neutral stem alignment in 83.33% and cup placement within the reported Lewinnek safe zone in 89.74% indicate generally satisfactory implant positioning. No aseptic loosening was recorded over the available follow-up. These findings are comparable with several studies summarized in the thesis, including reports of good functional outcomes and low rates of early radiological failure following contemporary uncemented THA. [9,10,14–18,21–23]

The complication profile was acceptable for a mixed-pathology retrospective series. The 3.84% dislocation rate was the principal early complication. The thesis attributes the relatively low rate, despite predominant posterior approach use, to meticulous posterior capsulorrhaphy, reattachment of the short external rotators, hip precautions and physiotherapy. One case of Brooker grade II heterotopic ossification and one case of clinically relevant limb-length discrepancy were reported. This study has important limitations. Its retrospective, single-centre design introduces selection bias and limits causal inference. The follow-up duration was variable and predominantly short-to-mid-term, preventing assessment of late polyethylene wear, progressive osteolysis and long-term aseptic loosening. The fixation groups were markedly unequal, limiting meaningful comparison between cemented, uncemented and hybrid implants. In addition, the thesis did not include broader patient-reported quality-of-life measures such as EQ-5D or SF-36.

CONCLUSION

Primary total hip arthroplasty produced marked pain relief, substantial functional improvement and satisfactory radiological component positioning in this 78-patient retrospective institutional series. Mean MHHS improved significantly from 38.63 ± 5.40 preoperatively to 83.93 ± 10.93 at the overall paired final assessment ($p < 0.001$), while the 3-year subgroup reached 87.93 ± 2.46 . Mean VAS similarly decreased from 7.29 ± 0.99 to 0.56 ± 0.66 ($p < 0.001$), with a 3-year subgroup value of 0.13. AVN was the predominant indication, and uncemented fixation was the most commonly used construct. Radiological fixation remained satisfactory with no observed aseptic loosening during the available follow-up. THA therefore remains an effective treatment for advanced hip pathology in this setting, while larger multicentre studies with 10–15 years of follow-up are required to establish long-term implant survivorship.

Declarations

Funding: None declared.

Conflict of interest: None declared.

Ethical approval: The thesis states that the study was conducted after institutional ethical considerations/approval; the exact approval number should be inserted from the institutional ethics certificate before journal submission.

Informed consent: The thesis contains a patient consent form. For publication, confirmation of consent for use of clinical/radiographic photographs should be documented according to the target journal's requirements.

Data availability: Data were derived from the institutional records and thesis master chart; availability should be stated according to institutional policy.

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