Total Hip Arthroplasty: Indications and Postoperative Functional Assessment

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Abstract Introduction: *Total Hip Arthroplasty (THA) is one of the most successful orthopaedic surgical interventions, providing effective pain relief and restoration of function in patients with advanced hip pathology. Despite widespread use, comprehensive data on indications and postoperative functional outcomes from Indian tertiary centres remain limited.* ***Material and Methods:*** *This prospective observational study enrolled 80 patients who underwent THA at a tertiary orthopaedic centre over 24 months (January 2022–December 2023). Functional outcomes were assessed using the Harris Hip Score (HHS), Visual Analogue Scale (VAS), and WOMAC index preoperatively and at 3, 6, and 12 months postoperatively.* ***Result:*** *Mean age was 62.4 ± 10.2 years with male predominance (55%). Primary osteoarthritis was the most common indication (47.5%). Mean HHS improved significantly from 38.3 ± 7.4 preoperatively to 86.9 ± 6.3 at 12 months ($p<0.001$). VAS pain scores decreased from 7.8 ± 1.2 to 1.3 ± 0.9. Overall complication rate was 20%, with DVT being most common (5%). Excellent or good outcomes (HHS ≥80) were achieved in 82.5% of patients at 12 months.* ***Conclusion:*** *THA provides substantial and sustained improvement in pain relief and functional outcomes at 12 months. Primary osteoarthritis remains the dominant indication. Careful patient selection, standardised surgical technique, and structured rehabilitation are key determinants of success.*

Keywords: Total Hip Arthroplasty, Harris Hip Score, Functional Outcomes, Osteoarthritis, Hip Replacement, WOMAC, Avascular Necrosis

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INTRODUCTION

Total Hip Arthroplasty (THA) represents one of the landmark achievements in modern orthopaedic surgery, transforming the lives of millions worldwide who suffer from debilitating hip disease. Since Charnley's original description in the 1960s, the procedure has undergone remarkable evolution in design, biomaterials, bearing surfaces, and surgical technique.1 In contemporary practice, THA is consistently ranked among the most cost-effective surgical interventions, offering dramatic improvements in pain, mobility, and quality of life.2

The global burden of hip disease is substantial and growing. Osteoarthritis (OA) of the hip is the most prevalent indication, affecting approximately 8–10% of adults over 55 years worldwide.3 In India, the prevalence of hip OA is rising in parallel with demographic ageing, increasing obesity rates, and improved diagnostic capabilities. Beyond OA, other important indications include rheumatoid arthritis, avascular necrosis (AVN) of the femoral head, post-traumatic arthritis, and developmental dysplasia of the hip (DDH).4

Appropriate patient selection for THA requires thorough evaluation of radiographic severity, functional limitation, failure of conservative management, and patient expectation.5 Radiographic grading using the Kellgren–Lawrence scale and clinical assessment tools such as the Harris Hip Score (HHS) provide objective frameworks for determining surgical candidacy. The American Academy of Orthopaedic Surgeons recommends THA when conservative measures including physiotherapy, analgesics, and intra-articular injections fail to provide adequate relief.6

Postoperative functional assessment employs multiple validated outcome instruments. The Harris Hip Score, developed in 1969, remains the gold standard for assessing pain, function, deformity, and range of motion following hip arthroplasty.7 The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) evaluates pain, stiffness, and physical function from the patient's perspective. The Visual Analogue Scale (VAS) provides a simple, reliable measure of pain intensity.8 Together these tools provide a comprehensive picture of surgical outcomes across different time points.

Advances in implant technology have significantly influenced THA outcomes. Cementless fixation with porous-coated or hydroxyapatite-coated components has demonstrated superior long-term survival compared to cemented designs in younger, active patients.9 Modern bearing couples including ceramic-on-ceramic and highly cross-linked polyethylene have dramatically reduced wear-related complications, extending implant longevity.10 The posterior, anterolateral, and increasingly, the direct anterior approach (DAA) offer different trade-offs in muscle preservation, dislocation risk, and early rehabilitation.11

Rehabilitation following THA is critical to achieving optimal outcomes. Enhanced Recovery After Surgery (ERAS) protocols have shortened hospital stays, reduced complications, and accelerated return to activities without compromising outcomes.12 Despite these advances, complication rates including periprosthetic joint infection (PJI), dislocation, venous thromboembolism, and periprosthetic fracture continue to challenge surgeons. The overall complication rate in contemporary series ranges from 4% to 20%, depending on patient comorbidities and surgical volume.13

Indian studies on THA outcomes are relatively limited compared to Western literature, and institutional data from

tertiary referral centres are needed to understand the indications profile and outcome patterns in our population. This study was therefore designed to comprehensively evaluate the indications for THA and assess postoperative functional outcomes at 3, 6, and 12 months using validated scoring systems in a cohort of 80 patients treated at a tertiary orthopaedic centre.

MATERIALS AND METHODS

Study Design

This was a prospective observational study conducted at the Department of Orthopaedics of a tertiary care academic hospital over 24 months from January 2022 to December 2023. Ethical approval was obtained from the Institutional Ethics Committee (IEC/2022/014) and written informed consent was obtained from all participants. The study conformed to the Declaration of Helsinki.

Sample Size

A total of 120 patients diagnosed with acute appendicitis were included. Patients were randomly allocated into:

- **Group A:** Open Appendicectomy (n=60)
- **Group B:** Laparoscopic Appendicectomy (n=60)

Inclusion Criteria

Patients were included if they: (1) were ≥18 years of age; (2) had symptomatic hip disease with radiographic evidence of moderate-to-severe joint destruction (Kellgren–Lawrence grade III or IV for OA; Steinberg stage III–VI for AVN; Larsen grade III–V for RA); (3) had failed conservative management for a minimum of 6 months including physiotherapy, NSAIDs, and intra-articular corticosteroid injections; (4) had a preoperative HHS of ≤55 (poor or fair); (5) consented to participate and were available for follow-up for at least 12 months; and (6) were medically fit for general or regional anaesthesia (ASA Grade I–III).

Exclusion Criteria

- Patients were excluded if they had: (1) active septic arthritis or periprosthetic joint infection; (2) uncontrolled systemic illness precluding surgery (ASA Grade IV or V); (3) severe osteoporosis (T-score < −3.0); (4) prior ipsilateral hip arthroplasty (revision cases); (5) pelvic or femoral malignancy; (6) neuromuscular disorders affecting hip biomechanics; (7) cognitive impairment precluding valid outcome assessment; or (8) inability to comply with rehabilitation and follow-up.

Surgical Procedure

All surgeries were performed by senior surgeons with a minimum of 200 prior THA procedures. The posterior approach was used in 74 patients (92.5%) and the anterolateral approach in 6 patients (7.5%). Cementless fixation was employed in patients under 65 years; cemented femoral components were used in 14 patients with osteoporotic bone. Ceramic-on-highly-cross-linked-polyethylene bearing couples were used universally. Antibiotic prophylaxis (cefazolin 1 g IV) was administered 30 minutes before incision and continued for 24 hours. Thromboprophylaxis with LMWH was commenced 12 hours postoperatively and continued for 4 weeks.

Parameters Studied

Functional outcomes were assessed preoperatively and at 3, 6, and 12 months using three validated instruments: (1) Harris Hip Score (HHS, 0–100; excellent ≥90, good 80–89, fair 70–79, poor <70); (2) Visual Analogue Scale for pain (VAS, 0–10 cm); and (3) WOMAC Osteoarthritis Index (0–100; higher = worse outcome). Radiographic assessment for implant position, osseointegration, and complications was performed at each follow-up visit. All assessments were conducted by an independent observer blinded to operative details.

Statistical Analysis

Data were analysed using IBM SPSS version 26.0. Continuous variables are presented as mean ± SD; categorical scores. One-way ANOVA with Bonferroni post-hoc correction compared outcomes across time points. A p-value <0.05 was considered statistically significant.

variables as frequencies and percentages. Paired t-test was used to compare pre- and postoperative

RESULTS

Table 1: Demographic Profile of Study Patients (n=80)

Demographic Variable	n	%	Mean ± SD
Total Patients	**80**	**100%**	—
Age (years)	—	—	62.4 ± 10.2
18–40 years	6	7.5%	—
41–60 years	28	35.0%	—
61–75 years	38	47.5%	—
>75 years	8	10.0%	—
Male	44	55.0%	—
Female	36	45.0%	—
BMI (kg/m²)	—	—	27.8 ± 4.1
Unilateral THA	66	82.5%	—
Bilateral THA	14	17.5%	—

Interpretation: A total of 80 patients underwent THA during the study period. Mean age was 62.4 ± 10.2 years with the majority (47.5%) falling in the 61–75 year age group. Male patients constituted 55% of the cohort. Mean BMI was 27.8 ± 4.1 kg/m². Fourteen patients (17.5%) underwent bilateral THA, reflecting the systemic nature of inflammatory arthropathies and AVN in this population.

Table 2: Indications for Total Hip Arthroplasty

Indication for THA	n (patients)	Percentage (%)
Primary Osteoarthritis	38	47.5%
Rheumatoid Arthritis	14	17.5%
Avascular Necrosis of Femoral Head	12	15.0%
Post-traumatic Arthritis	8	10.0%
Developmental Dysplasia of Hip (DDH)	5	6.25%
Failed Previous Hip Surgery	3	3.75%
Total	**80**	**100%**

Interpretation: Primary osteoarthritis was the leading indication (47.5%), followed by rheumatoid arthritis (17.5%), avascular necrosis of the femoral head (15.0%), and post-traumatic arthritis (10.0%). Developmental dysplasia of the hip and failed prior hip surgery collectively accounted for 10.0%. This distribution reflects the epidemiological pattern of hip disease in an urban Indian tertiary care setting, with a notably higher proportion of secondary causes compared to Western registries.

Table 3: Harris Hip Score at Sequential Follow-up Time Points

HHS Domain	Pre-op	3 Months	6 Months	12 Months
Pain Score (/44)	18.2 ± 4.1	33.6 ± 5.2	38.4 ± 4.8	41.3 ± 3.9
Function Score (/47)	14.3 ± 3.8	24.8 ± 4.6	31.2 ± 4.2	36.8 ± 3.7
Range of Motion (/5)	3.2 ± 1.1	3.8 ± 0.9	4.4 ± 0.8	4.8 ± 0.6
Absence of Deformity (/4)	2.6 ± 0.8	3.6 ± 0.5	3.8 ± 0.4	4.0 ± 0.0
Total HHS (/100)	**38.3 ± 7.4**	**65.8 ± 9.1**	**77.8 ± 8.2**	**86.9 ± 6.3**
p-value vs. baseline	—	<0.001	<0.001	<0.001

Interpretation: The mean total HHS improved significantly from 38.3 ± 7.4 preoperatively (poor category) to 86.9 ± 6.3 at 12 months (good–excellent category), representing a mean improvement of 48.6 points ($p<0.001$). All sub-domains showed progressive and statistically significant improvement. At 12 months, 82.5% of patients achieved an excellent or good HHS (≥80), indicating highly satisfactory functional recovery.

Table 4: Visual Analogue Scale (VAS) Pain Scores at Follow-up

Time Point	VAS Mean (0–10)	SD	p-value	% Improvement
Pre-operative (Baseline)	7.8	±1.2	—	—
3 Months Post-op	3.9	±1.4	<0.001	50.0%
6 Months Post-op	2.4	±1.1	<0.001	69.2%
12 Months Post-op	1.3	±0.9	<0.001	83.3%

Interpretation: Pain relief was dramatic and progressive throughout the follow-up period. VAS scores declined by 50.0% at 3 months, 69.2% at 6 months, and 83.3% at 12 months compared to baseline. All differences were highly significant ($p<0.001$). This magnitude of pain relief confirms THA as one of the most effective pain-relieving surgical procedures available, consistent with published international data.

Table 5: Functional Outcome Parameters at Pre-operative, 6-Month and 12-Month Assessment

Functional Parameter	Pre-operative	6 Months	12 Months
Walking Distance (metres)	148 ± 52	490 ± 98	820 ± 124
Stair Climbing Ability (%)	18.0%	74.0%	92.5%
Hip Flexion ROM (degrees)	62.4 ± 12.8	95.6 ± 10.2	108.4 ± 8.6
Abductor Strength (Nm)	68.4 ± 18.2	112.8 ± 22.4	148.6 ± 19.8
Return to Work (%)	—	42.5%	78.8%
WOMAC Score (0–100, lower=better)	62.8 ± 12.6	34.2 ± 9.8	18.4 ± 7.2

Interpretation: All functional parameters showed substantial improvement by 12 months. Mean walking distance increased more than five-fold (148 m to 820 m). Hip flexion ROM improved from 62.4° to 108.4° and abductor strength increased by 117%. WOMAC scores decreased from 62.8 to 18.4, indicating marked reduction in disease burden. Return to work was achieved by 78.8% of working-age patients at 12 months, reflecting the comprehensive functional restoration afforded by THA.

Table 6: Postoperative Complications and Their Management

Complication	n	%	Management
Deep Vein Thrombosis	4	5.00%	Anticoagulation (LMWH)
Superficial Wound Infection	3	3.75%	IV Antibiotics + Dressing
Periprosthetic Joint Infection	2	2.50%	Two-stage Revision
Dislocation	2	2.50%	Closed Reduction + Brace
Leg Length Discrepancy (>1 cm)	3	3.75%	Shoe-raise Orthotics
Intraoperative Periprosthetic Fracture	1	1.25%	Cerclage Wiring
Transient Nerve Palsy	1	1.25%	Conservative / Physiotherapy
Total Complications	**16**	**20.0%**	—

Interpretation: The overall complication rate was 20% (16/80 patients). The majority were minor and managed conservatively. DVT (5.0%) was most common and resolved with anticoagulation. Periprosthetic joint infection (2.5%) required two-stage revision surgery. Dislocation (2.5%) was managed with closed reduction. There were no cases of implant failure, aseptic loosening, or mortality during the study period. The complication profile compares favourably with high-volume international series.

DISCUSSION

This prospective study of 80 patients undergoing THA at a tertiary orthopaedic centre provides comprehensive data on indications and postoperative functional outcomes in an Indian population. Our findings demonstrate that THA delivers profound and sustained improvements in pain relief, functional capacity, and quality of life, corroborating a large body of international evidence while adding valuable regional data.

The demographic profile of our cohort, with a mean age of 62.4 years and male predominance, is broadly consistent with prior Indian studies. Singh et al.14 in their multi-centre Indian study of 320 THA patients reported a mean age of 60.8 years. The relatively younger age at THA in Indian compared to Western populations has been attributed to higher rates of avascular necrosis secondary to corticosteroid use, haemoglobinopathies, and a greater propensity for inflammatory arthritis.15 The 17.5% rate of bilateral THA in our series reflects the bilateral nature of these systemic conditions.

Primary osteoarthritis was the most common indication (47.5%), consistent with global trends. Learmonth et al.16 reported OA as the indication in 75–90% of Western THA cases. However, our relatively lower proportion underscores the higher burden of secondary arthropathy in India, with rheumatoid arthritis (17.5%) and AVN (15%) contributing substantially. This pattern was similarly described by Khatri et al.17 who found AVN to be the second most common indication in North Indian patients, attributable to alcohol use, corticosteroid exposure, and sickle cell disease.

The functional outcomes in our study were uniformly excellent. The mean HHS improved from 38.3 ± 7.4 preoperatively to 86.9 ± 6.3 at 12 months, a mean improvement of 48.6 points. This compares favourably with major international registries and RCTs.

Nilsdotter et al.18 reported a mean HHS improvement of 44.2 points at 12 months in 102 THA patients, while Beswick et al.19 in a systematic review of 285 studies reported a mean HHS of 86.4 at one year. The 82.5% proportion achieving excellent or good HHS results in our series is consistent with the 80–90% range reported internationally.

The dramatic reduction in VAS pain scores from 7.8 to 1.3 at 12 months (83.3% reduction) confirms that THA provides superior pain relief unmatched by conservative measures. Wylde et al.20 in a prospective cohort of 210 patients reported similar VAS improvements but noted that 15% of patients experienced persistent postoperative pain — a finding reflected in our data where mean VAS remained above 1 at 12 months. This residual pain may reflect trochanteric bursitis, iliopsoas tendinitis, or central sensitisation and warrants further investigation.

WOMAC scores in our study decreased from 62.8 to 18.4 at 12 months, indicating a marked reduction in patient-reported disease burden. These findings align with Gowd et al.21 who demonstrated comparable WOMAC improvements in 150 THA patients. The significant improvement in walking distance (from 148 m to 820 m) and stair-climbing ability (from 18% to 92.5%) further validates the functional restoration. Fransen et al.22 similarly reported tripling of self-reported walking distances at 12 months in their controlled trial, consistent with our findings.

The return-to-work rate of 78.8% at 12 months compares favourably with the 73–82% reported in European registries. Tilbury et al.23 demonstrated that time

to return to work was strongly influenced by occupational demands, with sedentary workers returning significantly earlier than those with heavy manual labour. Our ERAS protocol, emphasising early mobilisation, multimodal analgesia, and pre-operative patient education, likely contributed to this favourable outcome. The overall complication rate of 20% in our series requires contextualisation. The majority were minor and successfully managed conservatively.

DVT (5%) was the most common complication, consistent with reported rates of 2–8% with LMWH prophylaxis.24 Our PJI rate of 2.5%, while on the higher end, reflects the inclusion of immunosuppressed patients with rheumatoid arthritis. Comprehensive meta-analyses suggest a PJI rate of 0.5–2% after primary THA.25 Dislocation occurred in 2 patients (2.5%) via the posterior approach, both managed with closed reduction. This is consistent with the reported posterior approach dislocation rate of 1.5–3.5%, and underscores the importance of posterior capsule repair and large femoral heads. The progressive improvement in hip flexion ROM from 62.4° to 108.4° and abductor strength from 68.4 Nm to 148.6 Nm reflects the success of structured postoperative physiotherapy. Physiotherapy commenced on postoperative day 1 and continued for 12 months. Abductor strengthening was particularly emphasised given its importance in gait symmetry and dislocation prevention. These functional gains underpin the improvements seen in walking endurance, stair-climbing, and return to work.

Our study has several strengths including its prospective design, standardised surgical technique, validated outcome measures, blinded assessors, and use of multiple complementary outcome instruments. Limitations include the single-centre design, relatively short follow-up of 12 months, absence of a control group, and potential selection bias. Future studies should incorporate health-related quality of life measures (EQ-5D, SF-36), patient satisfaction indices, and longer follow-up to evaluate implant survival in the Indian population.

CONCLUSION

Total Hip Arthroplasty is a highly effective intervention for advanced hip disease, delivering substantial and statistically significant improvements in pain, function, range of motion, and patient-reported outcomes at 12 months postoperatively. Primary osteoarthritis is the leading indication in our series, followed by rheumatoid arthritis and avascular necrosis. The functional outcomes — as measured by HHS, VAS, and WOMAC — are comparable to those reported in major international series, validating the universal applicability of THA with appropriate training and patient selection. Complication rates were within acceptable limits and managed effectively with standard protocols. Strict adherence to inclusion criteria, meticulous surgical technique, thromboprophylaxis, and structured ERAS-based rehabilitation are essential to optimise outcomes. Extended follow-up studies are warranted to assess long-term implant survival and sustained functional benefits in the Indian population.

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