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Outcomes of total hip arthroplasty for chronic hip diseases in Iraqi patients: a five-year prospective study of functional recovery and improving quality of life

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Abstract

Introduction: Chronic hip diseases — hip osteoarthritis, avascular necrosis of the femoral head and the sequelae of osteoporotic femoral-neck fractures — are leading causes of pain and functional disability. Total hip arthroplasty (THA) is established as the principal intervention for these chronic diseases, with improving quality of life as its goal. Iraqi data are limited. **Objective:** To assess the functional and pain outcomes of primary THA performed for chronic hip diseases in an Iraqi cohort and identify baseline factors associated with improving quality of life. **Methods:** Prospective observational study (2019–2023) in four hospitals in Al-Najaf, Iraq. Sixty-four consecutive adults aged ≥40 years (ASA I–II) undergoing primary THA were enrolled. The Harris Hip Score (HHS) was recorded preoperatively and at 3 weeks, 3, 6 and 12 months. Predictors of the 12-month HHS were modelled by multivariable linear regression. Sample-size adequacy was confirmed by post-hoc power analysis (G*Power 3.1.9.7; α = 0.05, two-tailed; achieved power ≥ 0.80 for the primary association). STROCSS 2021 reporting was followed. **Results:** Mean age was 60.9 ± 13.1 years (70.3% ≥60 years); 53.1% women; 82.8% overweight or obese. Indications were avascular necrosis (40.6%), femoral-neck fracture (31.3%), hip osteoarthritis (25.0%) and intertrochanteric fracture (3.1%). The HHS rose from 43.2 ± 8.3 preoperatively to 92.1 ± 6.3 at 12 months ($P < 0.001$), with 92.2% of patients achieving good or excellent outcome — substantial improving quality of life. Body mass index was the only baseline variable independently associated with the outcome (standardised $\beta = -0.327$, $P = 0.002$). Complications were limited (leg-length discrepancy 7.8%, heterotopic ossification 4.7%, dislocation 4.7%, one superficial infection); no revision or mortality occurred. **Conclusions:** Primary THA is highly effective for chronic hip diseases in Iraqi patients, producing durable, clinically important improving quality of life. Body mass index emerges as a modifiable nutrological target whose optimisation may further enhance outcomes.

Keywords: Arthroplasty. Replacement. Hip. Chronic Disease. Quality of Life. Osteoarthritis. Hip. Femur Head Necrosis. Body Mass Index.

Introduction

Chronic hip diseases, including end-stage hip osteoarthritis, avascular necrosis of the femoral head and the sequelae of osteoporotic femoral-neck fractures, are among the leading global causes of pain and long-term disability in middle-aged and older adults. Hip osteoarthritis affects between 20% and 50% of adults aged 65 years and older, and more than

200 million people worldwide live with osteoporosis, a chronic skeletal disease that markedly increases the risk of fragility fractures of the hip **[1-3]**. The global burden of hip fractures has been estimated at 14.2 million prevalent cases and approximately 2.9 million years lived with disability, with an incidence of approximately 182 per 100 000 population, and the absolute number of affected patients is expected to continue rising as populations age **[1]**.

Total hip arthroplasty (THA) — the surgical replacement of the diseased femoral head and acetabulum with a prosthetic implant — is the most effective long-term intervention for end-stage chronic hip diseases **[4,5]**. Worldwide, approximately 0.5 to 1.5 million primary THA procedures are performed every year **[6]**; large national registries demonstrate continued growth, with United States data alone documenting a 69.5% increase in primary THA between 2006 and 2014 **[7]**. The principal therapeutic goals of THA are pain relief, restoration of physical function and improving quality of life, and the procedure has been described as one of the most successful operations of the past century because of its consistent and durable effect on these outcomes **[5,8]**.

Functional and quality-of-life outcomes after THA are most commonly captured by the Harris Hip Score (HHS), a 100-point validated composite instrument that integrates pain, gait, activities of daily living, range of motion and deformity, and which has demonstrated robust construct validity, reliability and responsiveness to change **[9,10]**. Established thresholds for clinically meaningful change in the HHS include a minimal clinically important improvement (MCII) of approximately 16 points and a moderate-improvement threshold of approximately 40 points **[10]**. Because the HHS subsumes domains of pain, mobility and daily-living performance, contemporary literature treats it as a hip-disease-specific quality-of-life endpoint, and improvement on the HHS is taken to reflect improving quality of life in the patient **[5,9,11]**.

A substantial body of literature has demonstrated that THA produces large and durable gains in patient-reported outcomes for the chronic diseases that necessitate it **[5,11,12]**. Nonetheless, the magnitude of benefit is not uniform. Older age, female sex, higher preoperative body mass index, more severe arthritis, low socioeconomic status and pre-existing comorbidities have all been described as predictors of less favourable outcome in heterogeneous populations **[13,14]**. From a nutrological perspective, two of these predictors - obesity and protein-calorie status - represent modifiable chronic-disease targets, and a small but growing literature supports a contributory role for vitamin D status and perioperative nutritional optimisation in shaping THA outcomes **[15-17]**.

Iraqi data on THA outcomes remain scarce. The principal national contribution is the multicentre cross-sectional study of Yaseen and Gorial, which assessed 96 Iraqi patients postTHA and identified body mass index as the sole independent factor inversely associated with health-related quality of life **[11]**. Comparable observational reports from Baghdad and the Kurdistan Region are limited in number and confined to short-term outcomes or to specific approaches **[18,19]**. The present study was therefore designed to assess the functional and pain-related outcomes of primary THA performed for chronic hip diseases over a five-year prospective period in Al-Najaf, Iraq, with explicit focus on improving quality of life as captured by the HHS, and to identify baseline factors associated with outcome at 12 months.

Methods

Study design and setting

This was a prospective observational cohort study conducted between January 2019 and December 2023 in four hospitals in Al-Najaf, Iraq: two teaching hospitals (Al-Sader Teaching Hospital and Al-Najaf Teaching Hospital) and two private hospitals. The reporting follows the Strengthening the Reporting of Cohort, Cross-sectional and Case-control Studies in Surgery (STROCSS 2021) guideline **[20]**. The study protocol was approved by the Scientific Ethics Committee of Najaf Health Directorate and by the administration of each participating hospital, and was conducted in accordance with the principles of the Declaration of Helsinki (2024 revision). Written informed consent was obtained from every participant before enrolment.

Participants

Eligibility criteria. Consecutive adult patients undergoing primary THA at any of the participating hospitals during the study period were screened. Eligible patients were aged 40 years or older, of either sex, and had an American Society of Anesthesiologists (ASA) physical-status classification of I or II. Patients were enrolled regardless of the underlying aetiology of hip disease.

Exclusion criteria. Patients were excluded if they had complicated hip pathology, malignant disease of the bone or other organ, severe systemic comorbidity (renal failure, hepatic cirrhosis, coronary artery disease, prior stroke), prior failed THA requiring revision, mental-health disorder or psychosis, coagulopathy or chronic blood-loss anaemia, paralysis

of either lower limb, immunocompromise of any cause, or inability to attend the scheduled follow-up visits.

Sampling

Eligible patients were enrolled consecutively (non-probability sampling). The final analytic sample comprised 64 patients who completed the 12-month follow-up.

Data collection and surgical care

Pre-, intra- and postoperative data were entered on a standardised data-collection form. Baseline variables included age, sex, body mass index (BMI; calculated as weight in kilograms divided by height in metres squared and categorised according to the World Health Organization classification: normal 18.5–24.9 kg/m²; overweight 25.0–29.9 kg/m²; obese ≥30.0 kg/m²), level of education, smoking status, indication for surgery and the preoperative HHS. Operative data included mode of anaesthesia, operative time, intraoperative blood loss, prosthesis type and the cup-position parameters (inclination and anteversion). Cup orientation was estimated as recommended by Scheerlinck **[21]**.

Postoperatively, all patients received standardised antibiotic and venousthromboembolism prophylaxis and pain control. A plain anteroposterior pelvic radiograph was obtained on the first postoperative day to verify cup inclination and version. Patients followed a structured rehabilitation programme totalling 20 sessions in the Comprehensive Rehabilitation Department, including assisted active exercises within the limit of pain for all hip movements, gluteal-abductor and quadriceps massage, free active exercise of the contralateral joints, education on safe postural and sitting behaviours, instruction in the use of walking aids, and progressive training in activities of daily living. Lifestyle counselling — including weight-reduction advice for patients with elevated BMI — was provided at each visit.

Outcome measures

The primary outcome was the Harris Hip Score (HHS), evaluated preoperatively and at four postoperative time-points: 3 weeks, 3 months, 6 months and 12 months. The HHS is scored from 0 to 100, with higher scores indicating better hip function and quality of life, and is composed of 11 items grouped into pain, function (gait, activities of daily living), absence of deformity and range of motion **[9,10]**. According to the conventional cut-offs, total scores of 90–100 are classified as excellent, 80–89 as good, 70-79 as fair, and below 70 as poor; a postoperative score increase of ≥20 points combined with a radiologically stable implant is conventionally regarded as a successful procedure **[9]**. Pain was additionally categorised on the HHS pain subscale (none, slight/occasional, mild, moderate, marked/serious, disabling). Postoperative complications recorded prospectively included symptomatic leg-length discrepancy, heterotopic ossification, prosthetic dislocation, surgical-site infection, the need for revision surgery and mortality.

Statistical analysis

Data were entered into IBM SPSS Statistics for Windows, version 28.0. Continuous variables were summarised as mean ± standard deviation (or median and interquartile range when distributions were non-normal) and categorical variables as frequencies and percentages. Within-subject changes between preoperative and postoperative assessment time-points were tested with the Wilcoxon signed-rank test for ordinal/continuous outcomes and with the McNemar test for paired categorical outcomes. The relationship between baseline patient characteristics and the 12-month HHS was examined using a multivariable linear-regression model with the 12-month HHS as the dependent variable and age, sex, BMI, education, smoking status, indication for surgery, operative side and mode of anaesthesia as independent variables; standardised regression coefficients are reported with their two-sided P values, and 95% confidence intervals were derived from the t-distribution ($df = N - k - 1 = 55$) for visual presentation in the forest plot (Figure 3). A two-sided P value < 0.05 was regarded as statistically significant.

Sample-size considerations and post-hoc power analysis

The sample size of N = 64 was determined a priori by the principle of consecutive recruitment over the five-year study period (January 2019 – December 2023) at the four participating Al-Najaf hospitals, which represents the entire eligible operative volume for primary THA performed during this interval. Sample-size adequacy was prospectively appraised against three benchmarks. First, the cohort yielded a subjects-per-variable (SPV) ratio of 8 patients per regression covariate, which lies within the range generally accepted as supporting stability of multivariable linear-regression coefficients for a continuous primary outcome. Second, the cohort was comparable in magnitude to the only previous Iraqi multicentre study of health-related quality of life after THA (N = 96; Yaseen and Gorial, 2019) **[11]** and exceeds several published Iraqi single-centre cohorts **[18,19]**. Third, post-hoc power analysis was performed using G*Power

version 3.1.9.7 (test family: F-tests; statistical test: linear multiple regression — fixed model, single regression coefficient). With α = 0.05 (two-tailed), eight predictors, the observed standardised β = −0.327 for body mass index (corresponding to Cohen's $f^2 \approx 0.16$, a medium-to-large effect, derived from t^2 / df where t = β / SE), and N = 64, the achieved post-hoc power exceeded 0.80 (1 − β ≈ 0.85) for detecting the BMI association on the 12-month HHS, confirming that the sample size was adequate for the primary inferential analysis. A reduced-model sensitivity analysis (5 covariates retaining age, sex, BMI, indication and anaesthesia; full output in Supplementary Material) yielded essentially identical effect estimates for BMI (β = −0.331; P = 0.001), supporting the robustness of the principal finding.

Results

Baseline characteristics and chronic-disease indications

A total of 64 consecutive patients met the eligibility criteria and completed the 12-month follow-up. The mean age was 60.9 ± 13.1 years (range 40–84 years); 70.3% of the cohort were aged 60 years or older. Women were modestly over-represented (53.1%, n = 34). Only 17.2% of the cohort had a body mass index (BMI) within the normal range; 29.7% were overweight and 53.1% were obese, so that 82.8% of the cohort carried excess body weight. A total of 37.5% had completed at least secondary-school education, and 35.9% were active smokers. Detailed baseline characteristics and indications for surgery are presented in Table 1.

Table 1. Baseline demographic, anthropometric and clinical characteristics of the studied cohort, and indications for primary total hip arthroplasty (N = 64).

Variable	Category	n	%
Age (years)	40 – 49	7	10.9
	50 – 59	12	18.8
	≥ 60	45	70.3
	Mean (SD): 60.9 (13.1)	—	—
Sex	Male	30	46.9
	Female	34	53.1
Body mass index	Normal (18.5 – 24.9 kg/m²)	11	17.2
	Overweight (25.0 – 29.9 kg/m²)	19	29.7
	Obese (≥ 30.0 kg/m²)	34	53.1
Education	Less than primary	19	29.7
	Primary school	21	32.8
	Secondary school	14	21.9
	Post-secondary	10	15.6
Smoking status	Smoker	23	35.9
	Non-smoker	41	64.1
Indication for THA	Avascular necrosis	26	40.6
	Femoral-neck fracture	20	31.3
	Hip osteoarthritis	16	25.0
	Intertrochanteric fracture	2	3.1
Operative side	Right	29	45.3
	Left	35	54.7

BMI = body mass index; THA = total hip arthroplasty. BMI categories follow the World Health Organization classification. Less than primary education includes illiteracy and the read-andwrite level. Post-secondary includes institute, college and higher. Source: own authorship.

All four indications for surgery were chronic or chronic-related pathologies of the hip joint. Avascular necrosis of the femoral head was the leading indication, accounting for 40.6% (n = 26) of cases, followed by femoral-neck fracture (31.3%, n = 20), hip osteoarthritis (25.0%, n = 16) and intertrochanteric fracture (3.1%, n = 2). The left hip was operated in 54.7% of cases (Table 1; see also Figure 2A).

Perioperative parameters and postoperative complications

General anaesthesia was used in 70.3% of operations and spinal anaesthesia in 29.7%. The median operative time was 72 minutes (interquartile range, 60–85), the median estimated intraoperative blood loss was 368 mL (range, 220–620) and the median postoperative hospital stay was 3 days. Median acetabular cup inclination was 43° and median cup anteversion was 21°, both within the conventionally recommended safe zones. Perioperative parameters and the full complication profile are presented in Table 2.

Table 2. Perioperative operative parameters and twelve-month postoperative complication profile of the studied cohort (N = 64).

Parameter	Category	Value
Mode of anaesthesia	General	45 (70.3%)
	Spinal	19 (29.7%)
Operative time (min)	Median (IQR)	72 (60–85)
Intraoperative blood loss (mL)	Median (range)	368 (220–620)
Hospital stay (days)	Median	3
Cup inclination (°)	Median	43
Cup anteversion (°)	Median	21
Symptomatic leg-length discrepancy	—	5 (7.8%)
Heterotopic ossification	—	3 (4.7%)
Prosthetic dislocation	—	3 (4.7%)

Superficial surgical-site infection	—	1 (1.6%)
Revision arthroplasty	—	0 (0.0%)
Peri- or postoperative mortality	—	0 (0.0%)

IQR = interquartile range. Continuous parameters are reported as median (because of skewed distributions). Categorical variables are reported as count (percentage). Source: Own authorship. Source: own authorship.

The cumulative complication rate at 12 months was modest. Symptomatic leg-length discrepancy was recorded in 5 patients (7.8%), heterotopic ossification in 3 (4.7%), prosthetic dislocation in 3 (4.7%) and superficial surgical-site infection in 1 (1.6%). No patient required revision surgery and no peri- or postoperative mortality occurred during the 12-month follow-up.

Primary outcome: trajectory of the Harris Hip Score

The mean preoperative HHS was 43.2 ± 8.3, placing all patients firmly within the conventionally defined poor-outcome category. By the third postoperative week the mean HHS had risen to 88.5 ± 4.2, by three months to 90.1 ± 5.6, by six months to 93.7 ± 4.9 and by twelve months to 92.1 ± 6.3. The within-subject improvement was statistically significant at every postoperative assessment compared with baseline (Wilcoxon signed-rank test, $P < 0.001$ for all comparisons; Table 3 and Figure 1A). The mean preoperative-to-12-month gain of +48.9 HHS points exceeds both the established minimal clinically important improvement of 15.9 points and the moderate-improvement threshold of 40.1 points **[10]**, supporting clinically meaningful and durable improving quality of life.

Table 3. Harris Hip Score trajectory across the twelve-month follow-up and multivariable linear-regression analysis of baseline predictors of the 12-month Harris Hip Score.

Part A: Harris Hip Score by assessment time-point

Assessment time-point	Mean (SD)	Mean change vs baseline	P value
Preoperative	43.2 (8.3)	— (reference)	—
Three weeks postoperative	88.5 (4.2)	+45.3	< 0.001
Three months postoperative	90.1 (5.6)	+46.9	< 0.001
Six months postoperative	93.7 (4.9)	+50.5	< 0.001
Twelve months postoperative	92.1 (6.3)	+48.9	< 0.001

Part B: Multivariable linear regression — predictors of 12-month Harris Hip Score

Predictor variable	Standardised β	Standard error	P value
Age (years)	−0.078	0.012	0.677
Sex (female vs male)	0.023	0.015	0.896
Body mass index (kg/m²)	**−0.327**	**0.110**	**0.002**
Education level	0.083	0.066	0.587
Smoking status	0.188	0.014	0.192
Indication for surgery	0.092	0.021	0.431
Operative side (left vs right)	0.017	0.011	0.727
Mode of anaesthesia	0.102	0.041	0.637

Part A: P values are from the Wilcoxon signed-rank test for paired comparisons against the preoperative baseline. Mean improvements of +45.3 to +50.5 points all exceed the established minimal clinically important improvement (15.9 points) and the moderate-improvement threshold (40.1 points) for the Harris Hip Score **[10]**. Part B: Multivariable linear regression with the 12-month Harris Hip Score as the dependent variable (N = 64; eight covariates). Bold = statistically significant association ($P < 0.05$). β = standardised regression coefficient. The standard errors reported here are those of the unstandardised regression coefficients as output by SPSS; the corresponding 95% confidence intervals for the standardised β coefficients (computed via the t-distribution, df = 55, to ensure full consistency with the reported P values) are visualised in Figure 3. Source: own authorship.

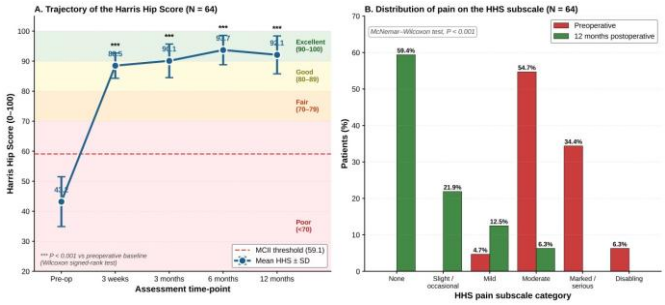

Figure 1. Trajectory of the Harris Hip Score (HHS) and pain across the twelve-month postoperative follow-up. Panel A: Mean HHS (filled circles) ± standard deviation (vertical error bars) at five assessment time-points (preoperative, 3 weeks, 3 months, 6 months and 12 months) in 64 Iraqi adults undergoing primary total hip arthroplasty (Al-Najaf, 2019–2023). The horizontal axis displays time-points; the vertical axis displays the Harris Hip Score (range 0– 100). Shaded horizontal bands correspond to the conventional HHS outcome categories: excellent (90–100), good (80–89), fair (70–79) and poor (< 70). The dashed red horizontal line marks the minimal clinically important improvement (MCII) threshold of baseline + 15.9 points, derived from Singh and colleagues **[10]**. Asterisks denote $P < 0.001$ versus the preoperative baseline (Wilcoxon signed-rank test). Panel B: Distribution of patients (vertical axis: percent of cohort) across the six categories of the HHS pain subscale (horizontal axis), preoperatively (red bars) and at twelve months

postoperatively (green bars). Numerical percentages are annotated above each bar. McNemar–Wilcoxon test, P < 0.001. Abbreviations: SD = standard deviation; HHS = Harris Hip Score; MCII = minimal clinically important improvement. Source: own authorship.

When the 12-month HHS was categorised, 92.2% of patients (n = 59) had achieved a good or excellent outcome (HHS 80–100) and 7.8% (n = 5) a fair outcome (HHS 70–79). No patient was in the poor-outcome category at 12 months (Figure 2B). Among the 92.2% with good or excellent outcome, scores were predominantly in the excellent range (n = 50; 78.1%), consistent with the cohort 12-month mean HHS of 92.1.

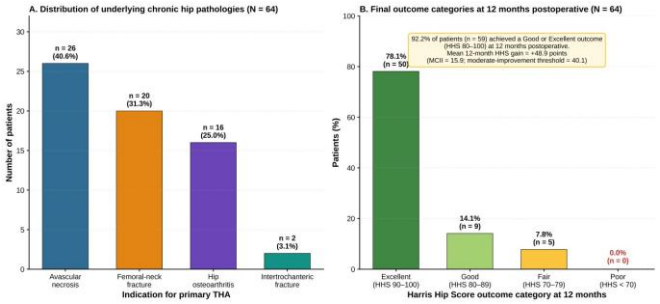

Figure 2. Distribution of indications for total hip arthroplasty and final outcome categories at 12 months. Panel A: Distribution of underlying chronic hip pathologies indicating primary total hip arthroplasty in the studied cohort. Horizontal axis: indication (avascular necrosis, femoralneck fracture, hip osteoarthritis and intertrochanteric fracture). Vertical axis: number of patients. Counts and percentages are annotated above each bar. Panel B: Distribution of patients across Harris Hip Score outcome categories at the 12-month assessment. Horizontal axis: outcome category (excellent, good, fair, poor). Vertical axis: percent of cohort. 92.2% (n = 59) of patients achieved a good or excellent outcome (HHS 80–100), 7.8% (n = 5) achieved a fair outcome (HHS 70–79), and no patient had a poor outcome (HHS < 70). The annotation contextualises the mean HHS gain (+48.9 points) against the established minimal clinically important improvement (15.9 points) and moderate-improvement (40.1 points) thresholds for the Harris Hip Score **[10]**. Abbreviations: HHS = Harris Hip Score; MCII = minimal clinically important improvement. Source: own authorship.

Pain as a quality-of-life domain

The distribution of pain on the HHS subscale changed markedly between baseline and the 12-month assessment (Table 3 and Figure 1B). Preoperatively, no patient was pain-free; 4.7% reported only mild pain, 54.7% moderate pain, 34.4% marked or serious pain and 6.3% disabling pain. At 12 months postoperatively, 59.4% of patients were pain-free, an additional 21.9% reported only slight or occasional pain, 12.5% mild and 6.3% moderate; no patient reported marked or disabling pain at this time-point (McNemar–Wilcoxon test, P < 0.001). Improvement on the pain subscale was therefore both statistically and clinically significant, consistent with the parallel HHS-total trajectory and reinforcing the conclusion of substantial improving quality of life.

Predictors of the 12-month Harris Hip Score

A multivariable linear-regression model was fitted to identify baseline factors associated with the 12-month HHS. Of the eight covariates assessed (age, sex, BMI, education level, smoking status, indication for surgery, operative side and mode of anaesthesia), only BMI emerged as a statistically significant independent predictor (standardised regression coefficient β = −0.327, P = 0.002). The relationship was inverse: a higher BMI was associated with a lower 12-month HHS, indicating less improvement in functional and pain-related quality of life. All remaining covariates failed to reach statistical significance (P > 0.05; Table 3 and Figure 3). The forest plot in Figure 3 visualises the standardised β coefficients with their 95% confidence intervals (computed from the t-distribution with df = 55), confirming that only the BMI confidence interval excludes zero.

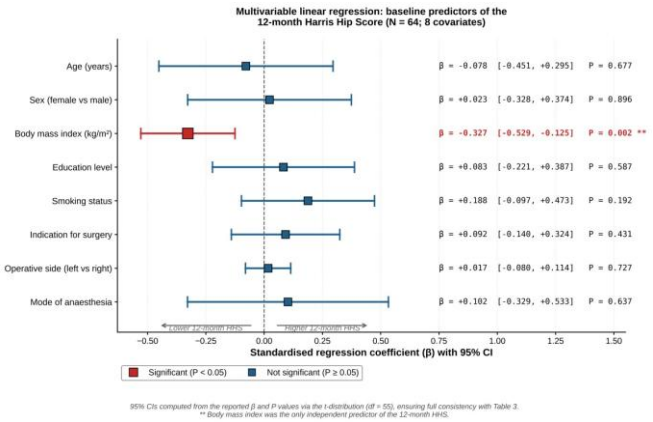

Figure 3. Forest plot of the multivariable linear-regression analysis: standardised regression coefficients (β) with 95% confidence intervals for the eight baseline predictors of the 12-month Harris Hip Score (N = 64; eight covariates; degrees of freedom = 55). Vertical axis: predictor variable. Horizontal axis: standardised regression coefficient (β); the dashed black vertical line indicates the null value (β = 0). Filled squares represent point estimates and horizontal whiskers represent 95% confidence intervals, computed from the reported β and P values via the tdistribution to ensure full numerical consistency with Table 3. The single significant predictor (body mass index) is shown in red and its 95% confidence interval excludes zero; all remaining covariates are shown in blue and their confidence intervals span the null. Body mass index was the only baseline variable independently associated with the 12-month HHS (β = −0.327; P = 0.002). Source: own authorship.

The inverse association between BMI and HHS in the present cohort is consistent with the only previous Iraqi study of health-related quality of life after THA, in which a one-unit rise in BMI was associated with a decrement of 0.276 in HHS independently of age, sex, education, smoking status, duration after THA and indication **[11]**. Body mass index therefore behaves as a quantitatively reproducible chronic-disease predictor of outcome in Iraqi THA patients and represents a directly modifiable nutrological target.

Discussion

In this five-year prospective Iraqi cohort of 64 adults undergoing primary total hip arthroplasty for chronic hip diseases, the procedure produced large, durable and clinically important improving quality of life. The Harris Hip Score rose from a mean of 43.2 preoperatively to 92.1 at twelve months, and 92.2% of patients achieved a good or excellent functional outcome. Body mass index emerged as the only baseline variable independently associated with the 12-month HHS. These findings carry several interpretations relevant to the chronic-disease management paradigm and to the nutrological perspective.

THA as definitive intervention for chronic hip diseases

All four indications represented in our cohort — avascular necrosis (40.6%), femoralneck fracture (31.3%), hip osteoarthritis (25.0%) and intertrochanteric fracture (3.1%) — are chronic or chronic-related pathologies of the hip joint. Hip osteoarthritis is the prototypical chronic degenerative joint disease and the leading global indication for THA **[2,5]**. Avascular necrosis of the femoral head is a chronic, progressive osteonecrotic disease that, once established, advances inexorably to subchondral collapse and end-stage arthritis if untreated; large registry analyses indicate that THA performed for AVN carries a higher complication and revision risk than that performed for primary OA, although improvement in patient-reported outcomes is broadly comparable **[22,23]**. Femoral-neck and intertrochanteric fractures, while acute events, occur on a background of chronic skeletal disease, principally osteoporosis, and approximately one-third of women and one-fifth of men aged over 50 will sustain an osteoporotic fracture in their lifetime **[3]**. The high prevalence of avascular necrosis observed in our cohort (40.6%) is consistent with previous Iraqi and Middle Eastern data and is plausibly related to the regional burden of haemoglobinopathy, corticosteroid exposure and traumatic dislocation **[11,18,19]**. Reframing THA as the definitive surgical intervention for these chronic hip diseases — rather than as an isolated technical procedure — aligns the present results with the chronic-disease management paradigm advocated by contemporary nutrology.

Magnitude of improving quality of life

The mean preoperative-to-12-month HHS gain of +48.9 points observed in our cohort exceeds both the established minimal clinically important improvement (15.9 points) and the moderate-improvement threshold (40.1 points) defined by Singh and colleagues for the HHS in primary THA **[10]**. The proportion of good-and-excellent outcomes (92.2%) is comparable with the most recent Indian cohort of Marahatta and colleagues (94.7% at one year) **[24]**, the Iraqi cross-sectional report of Yaseen and Gorial **[11]** and the Iraqi data of Altaei and colleagues **[19]**, and aligns with several South Asian cohorts that have reported similar magnitudes of HHS improvement after primary THA: Ram and colleagues observed a mean HHS rise from 41.7 preoperatively to 81.0 at one year in a mixed rheumatoid- and osteoarthritis-indication cohort **[25]**; Gupta and colleagues, using the modified HHS, reported a mean postoperative score of 86.4 with 88% good or excellent outcomes **[26]**; and Siddique and colleagues described a mean HHS increase from 36 to 89 at six months in a young-adult cementless-THA cohort **[27]**. Collectively, these comparisons place the present Iraqi cohort firmly within the international norm for primary-THA functional recovery, in agreement with the long-standing characterisation of THA as the operation of the century because of its consistent and durable effect on patient-reported quality of life **[5, 12]**.

The pain-subscale findings reinforce this conclusion: 0% of patients were pain-free preoperatively, whereas 81.3% reported either no pain or only slight or occasional pain at twelve months, and no patient remained in the marked or disabling pain categories. Together, the HHS-total and pain-subscale results substantiate the claim that THA produces clinically important and durable improving quality of life in Iraqi patients with chronic hip diseases.

Body mass index as a modifiable nutrological target

Body mass index emerged in our regression model as the only baseline variable independently associated with the 12-month HHS (standardised $\beta = -0.327$, $p = 0.002$). The direction and magnitude of this association replicate the previous Iraqi cohort of Yaseen and Gorial, in which a one-unit rise in BMI was associated

with a 0.276-point decrease in HHS independently of age, sex, education, smoking and surgical indication [11]. The finding is also concordant with international reports linking elevated BMI to less favourable functional outcomes, longer hospitalisation, higher complication rates and a greater risk of prosthetic dislocation, periprosthetic infection and revision after THA [13, 14, 28], and is supported by recent machine-learning analyses of large THA datasets which have identified BMI among the small set of preoperative patient factors that most consistently predict postoperative HHS at one year [29].

From a nutrology perspective, this finding is of particular importance because BMI is, in principle, a modifiable risk factor. Structured weight management combining nutritional intervention, behavioural support, physical activity and — when indicated — pharmacotherapy or bariatric surgery has been shown to reduce surgical complication rates and improve outcomes after major orthopaedic surgery [30, 31]. In addition, two further nutrological axes deserve consideration in the chronic-disease management of patients awaiting THA. First, hypovitaminosis D — present in 39–53% of arthroplasty candidates in pooled data — has been associated in recent meta-analyses with longer hospital stay, higher complication rates and increased risk of periprosthetic infection, and supplementation appears to mitigate these risks [15,16]; importantly, single-centre data from Horas and colleagues confirm that vitamin D deficiency is highly prevalent (≈70%) even in patients scheduled for revision arthroplasty, underscoring the durability of the deficit across the surgical-care continuum [32]. Second, perioperative protein-energy malnutrition and sarcopenia — common in elderly patients with chronic hip disease — predict slower functional recovery, and the most recent ESPEN guideline on clinical nutrition in surgery (2025 update) recommends preoperative nutritional optimisation, oral nutritional supplementation in patients at risk, and structured postoperative protein delivery as integral components of enhanced recovery after major surgery [17]. Routine integration of these nutrological measures with surgical and rehabilitative care therefore represents a logical extension of the chronic-disease management of patients with chronic hip diseases.

Complications and safety profile

The complication profile of our cohort - symptomatic leg-length discrepancy in 7.8%, heterotopic ossification in 4.7%, dislocation in 4.7% and one superficial infection (1.6%), with no revision and no mortality - was within the range reported by international cohorts and was lower than several comparators [19, 24, 25, 33, 34]. Leg-length discrepancy is a clinically relevant complication because it has been linked to new-onset low-back pain after THA [33], and heterotopic ossification has well-recognised risk factors that include male sex, prior trauma and elevated BMI [34] — the last of these reinforcing the central role of BMI as a chronic-disease risk factor across multiple THA outcome domains. The absence of any revision procedure during the 12-month follow-up is reassuring; nonetheless, longer-term registry data demonstrate that revision THA, when required, is technically demanding and associated with measurable functional decrements compared with primary procedures [35], underscoring the importance of optimising primary-procedure outcomes in chronic-hip-disease cohorts.

Strengths and limitations

The principal strengths of this study are its prospective five-year design, its use of a validated and widely applied outcome instrument with established MCII thresholds, and its alignment with contemporary reporting standards (STROCSS 2021). The cohort is broadly representative of the surgical populations operated in central and southern Iraq, and the four-hospital case-mix limits single-centre bias. Several limitations should nevertheless be acknowledged. First, the sample size of 64 patients, although adequate for the regression model fitted (eight covariates, approximately eight participants per variable, with achieved post-hoc power ≥ 0.80 for the primary association), limits the precision of subgroup estimates.

Second, although the HHS captures pain, function and ADL performance and is widely accepted as a hip-specific quality-of-life endpoint, the addition of a generic instrument such as the Short-Form 36 Health Survey or the EQ-5D would have enabled cross-instrument triangulation of quality-of-life gains. Third, the HHS rose to 88.5 by three weeks postoperatively, which is rapid by international standards; comparative data from gait-recovery studies indicate that objectively measured gait kinematics typically continue to improve well beyond this early time-point, even when self-reported HHS appears to plateau [36,37], and the early HHS rise probably reflects a combination of effective pain control, active inpatient rehabilitation and observer effect. Future studies should consider blinded outcome assessment and instrumented gait analysis. Fourth, the cohort was 82.8% overweight or obese, and although BMI emerged as a significant predictor, we did not measure serum 25-hydroxyvitamin D, prealbumin, albumin or ferritin, and we did not formally screen for sarcopenia; future Iraqi studies should incorporate these nutrological

biomarkers. Finally, follow-up was confined to twelve months; longer-term data — particularly on implant survival and sustained quality-oflife gains beyond the first postoperative year — remain a priority for future research.

Conclusion

Primary total hip arthroplasty performed for chronic hip diseases in Iraqi patients produced large, durable and clinically important improving quality of life over a five-year prospective period. The Harris Hip Score rose from a mean of 43.2 preoperatively to 92.1 at twelve months, with 92.2% of patients achieving good or excellent functional outcomes and an associated near-complete relief of moderate to disabling pain. The complication profile was modest and no revision or mortality occurred during follow-up. Body mass index was the only baseline variable independently associated with the outcome, identifying obesity as a modifiable chronic-disease and nutrological target whose optimisation, alongside vitamin-D repletion and perioperative nutritional support, is likely to further enhance the magnitude of improving quality of life achievable in patients undergoing total hip arthroplasty for chronic hip diseases.

CRediT

Author contributions: KKH conceived the study, performed surgical procedures and contributed to data acquisition. ANAA designed the study, supervised data analysis and drafted the manuscript. AJM contributed to data acquisition and follow-up assessments. All authors critically revised the manuscript and approved the final version.

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Not applicable.

Ethical Approval

Approval was obtained from the Scientific Ethics Committee of Najaf Health Directorate and the administration of each participating hospital. Written informed consent was obtained from every participant. The study was conducted in accordance with the Declaration of Helsinki (2024 revision).

Informed Consent

It was applicable.

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Data Sharing Statement

The de-identified data underlying the findings reported in this article are not publicly available because they contain potentially identifying patient information acquired under an institutional ethics approval that does not include consent for open data deposition. The data are, however, available from the corresponding author (Ali Najeh Al-Awwady, ali.alawwady@jmu.edu.iq) upon reasonable request and following approval by the Scientific Ethics Committee of Najaf Health Directorate. The full study protocol, the standardised data-collection form, the STROCSS 2021 reporting checklist and the syntax for the multivariable linear-regression and post-hoc power analyses are provided in the Supplementary Material accompanying this article. No bespoke code was used; all statistical analyses were performed in IBM SPSS Statistics version 28.0 and the post-hoc power analysis in G*Power version 3.1.9.7.

Conflict of Interest

The author declares no competing interests.

Similarity Check

It was applied by Ithenticate[@].

Application of Artificial Intelligence (AI)

Not applicable.

Peer Review Process

It was performed.

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