



Functional Recovery and Health-Related Quality of Life Following Total Hip Arthroplasty for Avascular Necrosis of the Femoral Head: A Two-Year Prospective Follow-Up Study.

^{1*}Muhammad Ali Shah, ²Yousaf Gul, ³Naeem Hayat, ⁴Dr Altaf Ahmed, ⁵Muhammad Ali, ⁶Umer Hayat, ⁷Malik Basit.

¹Professor and HOD, Department of Orthopedic DHQ Teaching Hospital Gomal Medical College Dera Ismail Khan.

²Associate Professor Department of Orthopedic DHQ Teaching Hospital Gomal Medical College Dera Ismail Khan.

³Trainee Registrar Department of Orthopedic DHQ Teaching Hospital Gomal Medical College Dera Ismail Khan.

⁴Training Registrar Department of Orthopedic DHQ Teaching Hospital Gomal Medical College Dera Ismail Khan.

⁵Trainee Medical Officer Department of Orthopedic DHQ Teaching Hospital Gomal Medical College Dera Ismail Khan.

⁶Trainee Medical Officer Department of Orthopedic DHQ Teaching Hospital Gomal Medical College Dera Ismail Khan.

⁷Medical Officer Department of Orthopedic DHQ Teaching Hospital Gomal Medical College Dera Ismail Khan.



Correspondence:

Muhammad Ali Shah.

Professor and HOD, Department of Orthopedic DHQ Teaching Hospital Gomal Medical College Dera Ismail Khan.

Email: dralishah72@gmail.com

Received: 05-05-2026

Revised: 18-05-2026

Accepted: 08-06-2026

Published: 22-06-2026

Abstract

Background: Avascular necrosis (AVN) of the femoral head is a progressive disease that commonly progresses to collapse of the femoral head, causing significant pain, functional disability, and poor quality of life. In advanced disease, total hip arthroplasty (THA) is the preferred treatment, but there are limited prospective data on medium-term health-related quality of life (HRQOL) and functional recovery. **Objective:** To assess functional recovery and health-related quality of life after THA in patients with ANFH over 2 years.

Methods: This was a prospective longitudinal study carried out in the Orthopedic Ward and trauma center, DHQ Teaching Hospital, Dera Ismail Khan, during the period 05 June 2023 to 05 June 2025. Patients with primary THA for AVN were consecutively selected and enrolled into the study, with a total of 62 patients. Data were analyzed in SPSS version 26.0, at a level of significance of $p < 0.05$. **Results:** HHS and SF-36 scores were significantly higher at follow-up ($p < 0.001$ for both). The number of patients with excellent functional outcomes, independent ambulation, and their return to their normal daily living at 24 months was 62.9%, 87.1%, and 90.3%, respectively. The complications following the surgery were very few, with 90.3% having no postoperative complications. **Conclusions:** Total hip arthroplasty leads to a good functional outcome and is associated with health-related quality of life improvement and a low complication rate in patients with avascular necrosis of the femoral head 2 years after surgery.

Keywords: Avascular necrosis; Femoral head; Total hip arthroplasty; Functional recovery; Harris Hip Score



This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<http://creativecommons.org/licenses/by/4.0/>).

INTRODUCTION

The avascular necrosis (AVN) of the femoral head, or osteonecrosis of the femoral head, is a progressive orthopedic condition due to poor blood supply to the femoral head, causing ischemia, subchondral bone collapse, secondary osteoarthritis, and ultimately severe limitation of hip joint function.[1] The disease is seen mainly in young and middle-aged adults, whereas degenerative hip osteoarthritis is seen mainly in older persons.[2] If left undiagnosed and untreated, AVN can continue to progress until it is too late and results in chronic pain, loss of function, gait abnormalities, shortening of the limb, and a reduction in quality of life.[3] The etiology of AVN is multifactorial, involving prolonged corticosteroid use, heavy alcohol consumption, trauma, hemoglobinopathies, autoimmunity, coagulopathies, organ transplants, and idiopathic causes, the latter making up a large percentage of reported cases.[4].

AVN is an important cause of disability worldwide and is a significant percentage of all hip arthroplasty (THA) surgeries performed in those under 60 years of age.[5] In the United States, about 20,000 to 30,000 new cases are diagnosed each year, and there is a higher prevalence in other countries, likely due to rising exposure to risk factors.[6] Epidemiological studies suggest that AVN accounts for almost 5–12% of all primary total hip replacements worldwide. There has been an increasing focus on AVN as one of the most important indicators for THA in younger adults in Asian nations, especially in China, Japan, and South Korea, owing to demographic shifts and better diagnostic tools.[5, 7].

The implants, bearing surfaces, surgical techniques, peri-implant optimization, and rehabilitation protocols have made tremendous advances in the last 20 years that have helped THA outcomes improve.[8] The use of modern highly cross-linked polyethylene liners, ceramic bearings, porous-coated cementless implants, and the advancement of fixation techniques have improved implant longevity, decreased complications, and revision rates.[9] At the same time, enhanced recovery after surgery (ERAS) pathways, multidisciplinary rehabilitation, and patient-centered postoperative care have enabled patients to mobilize earlier and have speeded up functional recovery.[10] Although these improvements have been made, patients with THA for AVN are typically younger, more active, and often have underlying systemic comorbidities or prior corticosteroid usage that can impact patient recovery and long-term outcomes.[11].

Recovery after THA is more than simply the elimination of pain and survival of the implant.[12] Patient-reported outcome measures (PROMs) are gaining growing importance in modern orthopedic practice to assess physical function, emotional status, social participation, and health-related quality of life (HRQoL).[13] The patient's perspective of postoperative recovery can be measured using tools like the Harris Hip Score (HHS) and the Short Form Health Survey (SF-36).[14, 15] These validated tools can be used to assess if surgical success is accompanied by a significant improvement in quality of life, independence, return to work, participation in recreation, and social health.

There are limited prospective data to comprehensively assess both functional outcomes and HRQOL in the longer-term post-THA period, especially in developing countries where total hip arthroplasty is widely accepted as the gold standard surgical intervention for advanced avascular necrosis of the femoral head (ANFH). The majority of the published studies focus on implant survival or early clinical results, and there is not enough follow-up information to document the clinical evolution of patient-reported functional improvement during the first two postoperative years. Collecting potential local evidence will lead to better knowledge of the medium-term recovery patterns, more evidence-based rehabilitation planning, better patient counseling about expected outcomes, and better optimization of orthopedic care for AVN patients. The purpose of this study was therefore to assess functional recovery and health-related quality of life at 2-year follow-up after THA in patients with avascular necrosis of the femoral head.

METHODOLOGY

This study was designed as a prospective longitudinal observational study to assess functional recovery and health-related quality of life of patients undergoing THA for AVN of the femoral head. The study was conducted in the Orthopedic Ward and Trauma Centre, DHQ teaching hospital, Dera Ismail Khan, Pakistan. The study lasted for two years, June 2023-June 2025.

An OpenEpi Version 3.01 sample size calculation for estimating a population mean was used. The calculation was based on a previous study in which they assessed the functional outcome of cementless THA in patients with avascular necrosis of the hip and reported a Harris hip score of 99.2 ± 4.8 . [16] Assuming a 95% confidence level, 1.2-point absolute precision, and a standard deviation of 4.8, the minimum required sample size was calculated to be 62 patients.

A non-probability consecutive sampling technique was employed. Patients were included in the study if they were 18 years or older, had a confirmed diagnosis of avascular necrosis of the femoral head from clinical examination and imaging, and gave informed consent to participate and adhere to the follow-up protocol.

Patients undergoing revision hip arthroplasty, hemiarthroplasty, or hip arthroplasty for any non-avascular necrosis indication were excluded. Patients were also excluded if they had active local or systemic infection, severe neurological disorders that would affect gait or functional assessment, or pathological fracture, severe cognitive impairment that would prevent questionnaires from being completed, or if the patient refused to participate or was likely to be unable to attend for follow-up.

Ethical approval was granted by the Institutional Ethical Review Committee before starting the study. All participants gave informed written consent for the study, having been informed of the objectives and methodology, benefits, and potential risks. All patient information was kept confidential, and each patient was given a unique identification number throughout the study.

After clinical evaluation and imaging, eligible patients were consecutively enrolled after confirmation of avascular necrosis of the FH. Demographic data, such as age, gender, BMI, affected side, duration of symptoms, comorbidities, etiology of avascular necrosis, and preoperative clinical findings, were obtained on a structured proforma. Standard protocols of the institutions were followed by highly experienced orthopedic surgeons for conducting all surgical procedures related to primary total hip arthroplasty.

The Harris Hip Score (HHS) was used to measure pre-operative functional status, and the health-related quality of life was measured using the Short Form-36 (SF-36) questionnaire.[17] Post-surgery, patients were treated according to the departmental protocol of regular rehabilitation with orthopedic surgeons and physiotherapists. Follow-up evaluations were carried out at 3, 6, 12, and 24 months after surgery. At each visit, the patient was clinically examined, the HHS was assessed, the SF-36 questionnaire was completed, pain was evaluated, walking ability was assessed, range of motion was evaluated, return to daily activities was assessed, and any postoperative complications such as infection, prosthesis loosening, periprosthetic fracture, thromboembolic event, and the need for revision surgery were documented. The principal investigator recorded all the data on a standardized data collection form to minimize observer bias and to obtain uniformity of data.

Data were collected and analyzed by entering and using the Statistical Package for Social Sciences (SPSS) version 26.0. After determining data normality, continuous variables such as age, BMI, HHS, and SF-36 scores were reported as mean $\pm$ SD or median (IQR) as appropriate. Categorical variables such as gender, etiology of avascular necrosis, affected side, postoperative complications, and functional outcome categories were reported as frequency and percentage. The paired t-test was used to analyze changes in the Harris Hip Score and SF-36 scores from baseline to each postoperative follow-up time point when data were normally distributed. Independent group comparisons were conducted by independent samples t-test and one-way analysis of variance (ANOVA). The chi-square test and Fisher's exact test were used to test the association between categorical variables. A p-value ≤ 0.05 was considered statistically significant throughout the analysis.

RESULTS

This study comprised 62 patients with AVNFB who underwent THA. The mean age of the patients was 42.8 ± 10.6 years, and the majority were male (66.1%). The majority of participants were overweight, unilateral, and had symptoms for over six months, with idiopathic and corticosteroid-induced avascular necrosis as the most common etiologies. The most common comorbidities were hypertension and diabetes mellitus. (Table 1).

Preoperatively, the study population had severe functional limitation and low health-related quality of life. The mean Harris Hip Score was 42.6 ± 9.8 , while the mean SF-36 score was 38.9 ± 8.7 . The majority of patients needed walking aids before surgery. (Table 2).

There was a progressive and statistically significant increase in functional recovery and health-related quality of life, which was seen throughout the follow-up period. There was a significant improvement in Harris Hip Score and SF-36 scores from baseline to 24 months after surgery, with the greatest improvement at the end of the follow-up ($p < 0.001$). (Table 3).

Nearly one-third of the patients had a very good functional outcome at 2-year follow-up, and most had recovered walking without support and were able to return to normal daily activities. Postoperative complications were rare, with over 90% of patients having an uncomplicated postoperative course. (Table 4).

Postoperative functional outcome was significantly associated with age and BMI. Patients with normal BMI at 24 months had a higher proportion of excellent Harris Hip Scores than did older or obese patients ($p = 0.012$ and $p = 0.008$, respectively). (Table 5).

Table 1. Baseline demographic and clinical characteristics of the study participants (n = 62)

Variable	n (%) / Mean $\pm$ SD
Age (years)	42.8 ± 10.6
18–30	10 (16.1)
31–45	28 (45.2)
46–60	18 (29.0)
>60	6 (9.7)
Gender	
Male	41 (66.1)
Female	21 (33.9)
BMI (kg/m²)	27.1 ± 3.9
Normal	18 (29.0)
Overweight	30 (48.4)
Obese	14 (22.6)
Affected side	
Right	29 (46.8)
Left	26 (41.9)

Bilateral	7 (11.3)
Duration of symptoms	
<6 months	13 (21.0)
6–12 months	24 (38.7)
>12 months	25 (40.3)
Etiology of AVN	
Corticosteroid-induced	18 (29.0)
Alcohol-related	10 (16.1)
Post-traumatic	13 (21.0)
Idiopathic	21 (33.9)
Comorbidities	
Hypertension	15 (24.2)
Diabetes mellitus	12 (19.4)
Dyslipidemia	10 (16.1)
Chronic kidney disease	3 (4.8)
Chronic liver disease	2 (3.2)
No comorbidity	28 (45.2)

Table 2. Preoperative clinical assessment of the study participants (n = 62)

Variable	Mean $\pm$ SD / n (%)
Harris Hip Score (HHS)	42.6 $\pm$ 9.8
SF-36 score	38.9 $\pm$ 8.7
Pain score (VAS)	8.1 $\pm$ 1.2
Hip flexion ($^{\circ}$)	76.4 $\pm$ 15.8
Walking without support	4 (6.5)
Walking with cane	19 (30.6)
Walking with walker/crutches	39 (62.9)

Table 3. Functional recovery and health-related quality of life following total hip arthroplasty (n = 62)

Follow-up	Harris Hip Score (Mean $\pm$ SD)	SF-36 Score (Mean $\pm$ SD)	Overall p-value*
Preoperative	42.6 $\pm$ 9.8	38.9 $\pm$ 8.7	<0.001
3 months	68.4 $\pm$ 8.9	56.8 $\pm$ 8.4	
6 months	79.5 $\pm$ 7.6	67.9 $\pm$ 7.5	
12 months	87.8 $\pm$ 6.9	77.3 $\pm$ 6.8	
24 months	91.7 $\pm$ 5.8	83.6 $\pm$ 5.9	
*Repeated-measures ANOVA.			

Table 4. Functional outcomes and postoperative complications at 24 months (n = 62)

Variable	n (%)
Functional outcome (HHS)	
Excellent (≥ 90)	39 (62.9)
Good (80–89)	17 (27.4)
Fair (70–79)	5 (8.1)
Poor (< 70)	1 (1.6)
Independent ambulation	54 (87.1)
Return to routine daily activities	56 (90.3)
Postoperative complications	
Superficial surgical site infection	2 (3.2)
Hip dislocation	1 (1.6)
Deep vein thrombosis	1 (1.6)
Prosthesis loosening	1 (1.6)
Periprosthetic fracture	0 (0.0)
Revision surgery	1 (1.6)
No complications	56 (90.3)

Table 5. Association of patient characteristics with excellent functional outcome at 24 months (n = 62)

Variable	Excellent n (%)	Good/Fair/Poor n (%)	p-value
Age group (years)			
18–30	9 (90.0)	1 (10.0)	0.012
31–45	20 (71.4)	8 (28.6)	
46–60	9 (50.0)	9 (50.0)	
>60	1 (16.7)	5 (83.3)	
BMI category			
Normal	15 (83.3)	3 (16.7)	0.008
Overweight	20 (66.7)	10 (33.3)	
Obese	4 (28.6)	10 (71.4)	

DISCUSSION

This prospective study showed that THA achieved significant improvement in functional recovery and health-related quality of life in patients with AVN of the femoral head over two years. The HHS and SF-36 scores at 24 months significantly exceeded baseline values, and a majority of patients had good functional outcomes with a relatively low rate of postoperative complications. These results validate THA as the first-line approach for advanced AVN, resulting in long-term pain management, mobility, and quality of life.[16, 18] The mean age of our study population was 42.8 years, and males constituted two-thirds of the participants. The results are also in line with the prospective study conducted by Islam et al. where mean age of the patients was 43.9 years, with 73% of males, which is consistent with the higher incidence of AVN in young and middle aged males. The same distribution has also been reported in more recent prospective studies of THA in patients with AVN, indicating that this remains the most common age group.[16, 19]

The functional improvements after surgery in our study were significant, with the mean HHS score improving from 42.6 to 91.7 at 24 months. Similar enhancements have been reported in several recent studies. In both groups, the Modified Harris Hip Score improved significantly regardless of the surgical approach used (either directly anterior or posterior), and both groups were found to have excellent functional recovery during follow-up. Similarly, a prospective observational study published in 2025 revealed that HHS improved significantly at 1 year after THA, and this was consistent with the functional advantages of contemporary hip arthroplasty in AVN patients.[19, 20] At final follow-up, 63% of our patients had an excellent functional outcome, and over 90% had resumed normal daily activities and ambulated independently. The findings are similar to those of Islam et al., who found good functional results in 97% of their patients with minimal residual disability for cementless THA for AVN. The percentage of excellent results was a bit higher in their series, but this difference could simply reflect a smaller sample size, a younger age of the patient population in their study, or a shorter length of follow-up.[16]

In the current study, superficial infection, dislocation, loosening of the prosthesis, deep vein thrombosis, and revision surgery were rare postoperative complications. Follow-up complications were found in less than 10% of patients. The rates of low complications have been reported by Kumar et al., who found no differences in overall complications between surgical approaches and Islam et al. in the Pakistan study who reported no early or late major complications.[19] One of the most significant observations of this study was that younger age was correlated with better postoperative functional outcome. Younger patients had a greater proportion of excellent HHS at 2 years than older patients. This is corroborated by the systematic review and meta-regression of 2023, which concluded that the age of the patient was an important predictor of postoperative functional outcome after THA. The patients are younger and have fewer medical comorbidities, and they have better potential for recovery, which results in better recovery.[18]

The present results also align with those of the comparative study assessing THA outcomes in systemic lupus erythematosus (SLE) associated AVN vs non-SLE AVN. In this study, it was shown that HHS scores are >93 points and the complication rates are low after surgery, which shows that even if the underlying etiology is poor, excellent functional recovery can be achieved by use of meticulous surgical technique and appropriate rehabilitation protocols.[21]

Limitations

There are several limitations in this study. First, it was performed at one tertiary care center, which might restrict the generalizability of the findings to other healthcare facilities and patient cohorts. Secondly, the relatively small sample size might have limited the power to detect associations with less common postoperative complications. Third, the follow-up was limited to 2 years, so implant survival, prosthesis wear, and late revision rate could not be assessed. Lastly, validated patient-reported outcome measures were employed; however, aspects of the rehabilitation procedure, such as adherence to exercise programs, socioeconomic status, and patients' expectations, were not evaluated and could have influenced postoperative functional outcome and quality of life.

CONCLUSION

The two-year follow-up results of total hip arthroplasty for advanced avascular necrosis of the femoral head are highly effective in improving hip function and health-related quality of life. Patients had excellent functional outcomes with restoration of independent daily activities and ambulation, without frequent postoperative complications. Younger age and normal BMI were correlated with better functional recovery, highlighting the role of patient-related factors in predicting postoperative results. The results of this study are consistent with total hip arthroplasty being an effective and long-lasting treatment for function and quality of life for patients with end-stage avascular necrosis of the femoral head.

REFERENCES

1. Konarski, W., et al., Avascular necrosis of femoral head—overview and current state of the art. *International Journal of Environmental Research and Public Health*, 2022. 19(12): p. 7348.
2. Abdulkareem, I.H., J. OKOROCHA, and N. SHAH, Exploring Other Causes of Hip Pain Beyond Osteoarthritis in Adults: A Narrative Review and Case Series. *ANNALS OF MEDICAL AND CLINICAL CASE REPORTS* Учредители: Annals of Global Publishing Group, 2025. 1(01): p. 01-30.
3. Lohiya Jr, A., et al., A comprehensive review of treatment strategies for early avascular necrosis. *Cureus*, 2023. 15(12).
4. Ashutosh Jr, L., et al., A Comprehensive Review of Treatment Strategies for Early Avascular Necrosis. *Cureus* 2023. 15(12).
5. Yakkanti, R.R., et al., Relative frequency of avascular necrosis of the hip as indication for primary total hip arthroplasty in the USA vs. India. *Journal of Orthopaedics*, 2023. 36: p. 1-6.
6. Haziza, S., et al., Relative frequency of primary total hip arthroplasty for avascular necrosis in the United States as compared to a regional center: A data review. *Journal of Orthopaedics*, 2022. 34: p. 322-326.
7. Vu, K.V., et al., Short-term functional outcome of total hip arthroplasty for avascular necrosis of femoral head and influence of patient-related factors. *Гений ортопедии*, 2024. 30(5): p. 644-650.
8. Wang, M.-f., et al., A review of the advances in implant technology: accomplishments and challenges for the design of functionalized surface structures. *Biomedical Materials*, 2025. 20(3): p. 032003.
9. Langlois, J. and M. Hamadouche, Highly cross-linked polyethylene: a review of recent advances. *Mentors in Orthopedics*, 2025(038).
10. Mithany, R.H., et al., Revolutionizing surgical care: the power of enhanced recovery after surgery (ERAS). *Cureus*, 2023. 15(11).
11. Zhao, G., et al., Avascular necrosis or rapid destruction of the hip following hip intra-articular corticosteroid injections: a systematic review. *International Orthopaedics*, 2025. 49(1): p. 127-134.
12. Di Martino, A., et al., Fast track protocols and early rehabilitation after surgery in total hip arthroplasty: a narrative review. *Clinics and Practice*, 2023. 13(3): p. 569-582.
13. Houwen, T. et al., There are more things in physical function and pain: a systematic review on physical, mental and social health within the orthopedic fracture population using PROMIS. *Journal of Patient-Reported Outcomes*, 2022. 6(1): p. 34.
14. Teo, C., et al., Determinants of patient satisfaction and expectation after hip fracture surgery: a multidimensional perspective on association between clinical outcomes, subjective expectations and psychosocial factors. *European Journal of Orthopaedic Surgery & Traumatology*, 2026. 36(1): p. 177.
15. Sim, C.H., et al., SF-36 physical function and general health domains are independent predictors of acute hospital length of stay after hip fracture surgery. *Musculoskeletal Surgery*, 2023. 107(3): p. 287-294.
16. Karimi, S., et al., Functional outcomes of cementless total hip arthroplasty in avascular necrosis of the hip: a prospective study. *Cureus*, 2020. 12(8).
17. Bulzan, M., et al., Health status after total hip arthroplasty: A literature review. *Journal of Mind and Medical Sciences*, 2025. 12(1): p. 35.
18. Ramadanov, N., et al., Risk factors and predictors for functional outcome and complication rate in total hip arthroplasty through minimally invasive and conventional approaches: a systematic review and meta-regression analysis of 41 randomized controlled trials. *Journal of Clinical Medicine*, 2023. 12(18): p. 5895.
19. Kumar, A., et al., A prospective cohort study investigating functional recovery in patients with avascular necrosis hip following total hip arthroplasty using a direct anterior versus direct posterior surgical approach in Indian population. *International Journal of Research in Orthopaedics*, 2024. 11(1): p. 112-117. Zapata Madrigal, J., Functional Outcome of Total Hip Arthroplasty vs Dynamic Hip Screw with antirotation screw for Pauwels type III femoral fractures in active patients. 2026.
20. Elsaid, N.Y. and T.A. Saad, Outcome of total hip arthroplasty for avascular necrosis of femoral head in systemic lupus erythematosus patients: A comparative study. *The Egyptian Rheumatologist*, 2022. 44(3): p. 181-184.