

Original Research Article

FUNCTIONAL OUTCOME OF UNCEMENTED TOTAL HIP REPLACEMENT IN AVASCULAR NECROSIS OF FEMORAL HEAD IN YOUNG ADULTS

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ABSTRACT

Background: Avascular necrosis (AVN) of the femoral head affects young adults and may progress to femoral-head collapse, pain, and functional disability. Uncemented total hip replacement (THR) is used for advanced disease. **Objective:** To evaluate functional outcomes after uncemented THR in young adults with AVN of the femoral head.

Materials and Methods: This prospective observational study included 30 patients aged 20–50 years with Ficat and Arlet stage III or IV AVN who underwent uncemented THR through a posterior Southern Moore approach at Parul Sevashram Hospital, Vadodara. Functional outcomes were assessed using Modified Harris Hip Score (MHHS) components preoperatively and at 6, 12, 24, and 48 weeks. Postoperative complications were recorded.

Results: Twenty-four participants (80%) were male and 18 (60%) had stage IV disease. The pain subscore increased from 21.0 ± 8.03 preoperatively to 40.93 ± 1.72 at 48 weeks ($P < 0.0001$), and the limp subscore from 4.23 ± 2.58 to 10.7 ± 0.92 ($P < 0.0001$). Walking-distance, stair-climbing, socks-wearing, sitting, and public-transport subscores also improved significantly. Postoperative Harris Hip Score grading was good in 20 participants, excellent in 9, and fair in 1. Twenty-four participants had no recorded postoperative complication; superficial infection occurred in 2, while deep infection, foot drop, iatrogenic fracture, and dislocation occurred in 1 participant each.

Conclusion: Uncemented THR was associated with progressive improvement in pain-related and activity-related hip function over 48 weeks in young adults with advanced AVN of the femoral head.

Keywords: Avascular necrosis; Femoral head; Uncemented total hip replacement; Modified Harris Hip Score; Young adults.

INTRODUCTION

The hip is the second largest weight-bearing joint in the human body after the knee joint. It is a ball-and-socket type of synovial joint. The rounded head of the femur forms the ball, which fits into the acetabulum (socket in the pelvis). The bony surfaces are covered by articular cartilage and smooth tissue, which cushions the ends of the bones and promotes joint motion.^[1]

Various conditions have been attributed as aetiological factors for avascular necrosis for femoral head. These include steroid therapy, autoimmune disease, hemoglobinopathies, hyper coagulopathies,

hyper-lipidaemia, Gaucher's disease, alcoholism, particularly trauma, and dislocation of the hip. Amongst haemoglobinopathies, patients with sickle cell anaemia are significantly appearing with ONFH. In India, sickle cell anaemia has been seen most commonly in areas of the sickle cell belt (south eastern Gujarat to south western Odisha and also including states like Madhya Pradesh, Chhattisgarh, Maharashtra-Vidarbha and Marathwada, Kerala-Wayanad and Tamil Nadu). All factors have a significant impact on the joint and cause pain and dysfunction.^[1]

ONFH has a complex aetiology, and the most common cause is idiopathic.^[2] In India, the mean age

of onset of femoral head necrosis is 34.71 years and the male to female ratio is 5:1.^[2] More than one-third (37.3%) of patients with ONFH with a known cause, have a history of long-term steroid usage, and chronic alcoholism is the underlying cause in 20.1% of the patients.^[2] Studies have shown that high-dose corticosteroids (>40 mg/day) significantly increase the risk of ONFH, and every 10 mg increase in the dose increases the incidence rate by 3.6%.^[3,4]

The treatment of femoral head avascular necrosis ranges from conservative to invasive. In the early stages, conservative therapies such as restricted weight bearing, physical therapy, termination of steroid therapy, and anti-inflammatory drugs are indicated.^[5,6] The surgical treatment can be divided into two categories: those that preserve the femoral head (core decompression, osteotomy, non-vascularized and vascularized bone grafting, and autologous bone grafting) and those that partially or completely replace the femoral head (hemiarthroplasty and total hip arthroplasty).^[7-9] The porous hydroxyapatite-coated prosthesis used in uncemented total hip arthroplasty promotes healing, which allows bone to grow into or onto the prosthesis has led to improved implant survival rates and supports their growing use.^[9,10] It was created to give an alternative to the poor results associated with early cemented total hip replacements. The early outcomes for cementless total hip replacements were unsatisfactory because the smooth surface of the cementless prosthesis inhibited good adhesion to the bone, resulting in aseptic loosening a few years after surgery.^[8] The discovery of porous-coated materials in the 1980s permitted bone in growth on the surface of prostheses, resulting in enhanced adhesion and improved prognosis.^[8] Preliminary data suggest that non cemented total hip arthroplasties have relatively low revision rate and excellent prosthetic durability.^[8] Evaluation of long-term outcomes of a procedure like total hip replacement is important to determine its durability. It provides a means of comparison of the results of different clinical interventions that may lead to changes in operative technique and implant design over time.

MATERIALS AND METHODS

Study design and setting

This was an observational study with prospective recording of data from patients undergoing uncemented total hip replacement (THR) for avascular necrosis (AVN) of the femoral head. The study was conducted in the Department of Orthopaedics at Parul Sevashram Hospital/Parul Institute of Medical Sciences & Research, Vadodara, Gujarat. Participants were recruited during a six-month period after ethics approval and were prospectively followed for 12 months.

Participants and sampling

Patients aged 20–50 years with Ficat and Arlet stage III or IV AVN of the femoral head who were willing

to provide informed consent were eligible. Patients with systemic or local infection were excluded. Convenience sampling was used. Approximately 36 uncemented THR cases performed for AVN during the preceding period were used as a reference for anticipated case availability; the final analysed cohort comprised 30 participants.

Clinical assessment and operative procedure

AVN was diagnosed by clinical examination, radiography, and magnetic resonance imaging and was classified according to the Ficat and Arlet staging system. All included patients underwent uncemented THR using the posterior Southern Moore approach. The hip was exposed by layer-by-layer dissection, the affected femoral head was excised, and the acetabulum and femoral canal were prepared for implant insertion. Wound closure was performed over a suction drain.

Follow-up and outcome assessment

Postoperative follow-up was scheduled at 2, 6, 12, 24, and 48 weeks. Functional outcomes were assessed using the Modified Harris Hip Score (MHHS), including pain, limp, support, distance walked, stair climbing, ability to wear socks, sitting, and use of public transport. Range of movement, deformity, limb-length discrepancy, femoral-stem position, acetabular inclination, postoperative Harris Hip Score grading, and postoperative complications were also recorded.

Statistical analysis

Data were analysed in Microsoft Excel. Continuous variables were presented as mean $\pm$ standard deviation and categorical variables as frequencies and percentages. Serial functional outcomes were reported using repeated-measures ANOVA with Friedman post hoc testing, with $P < 0.05$ considered statistically significant.

Ethics

The study was conducted after approval from the Parul University Institutional Ethics Committee for Human Research (PUIECHR). Participation was voluntary, and written informed consent was obtained after explanation of the study purpose and procedures. Confidentiality and the right to withdraw without affecting treatment were documented.

RESULTS

Participant characteristics

Thirty participants were included. The largest age groups were 31–35 years and 36–40 years, with 7 participants (23.33%) in each group. Twenty-four participants (80%) were male and 6 (20%) were female. Hypertension was recorded in 6 participants (20%) and diabetes mellitus in 5 (16.67%). Twelve participants (40%) had Ficat-Arlet stage III disease and 18 (60%) had stage IV disease. [Table 1]

Functional outcomes

Serial MHHS components improved over follow-up (Table 2). The pain subscore increased from 21.0 ± 8.03 preoperatively to 26.0 ± 7.24 at 6 weeks, $35.6 \pm$

6.57 at 12 weeks, 39.86 ± 3.01 at 24 weeks, and 40.93 ± 1.72 at 48 weeks (overall $P < 0.0001$). The limp subscore increased from 4.23 ± 2.58 to 10.7 ± 0.92 over the same interval ($P < 0.0001$). Support and distance-walked subscores also increased substantially by 48 weeks, with overall reported $P < 0.0001$. Stair-climbing, socks-wearing, sitting, and public-transport subscores improved progressively, with overall reported $P < 0.001$.

Other clinical outcomes

Range of movement improved after surgery: before surgery, 20 participants had $60\text{--}100^\circ$ of movement, 9 had $101\text{--}150^\circ$, and 1 had $151\text{--}200^\circ$; after surgery, 21 participants had $151\text{--}200^\circ$ and 9 had $>200^\circ$

($P < 0.001$). Flexion, adduction, abduction, rotational, and acetabular-inclination deformities recorded preoperatively were recorded as absent postoperatively. Limb-length discrepancy was present in 26 participants before surgery and 3 after surgery ($P < 0.001$). [Table 3]

Postoperative Harris Hip Score grading was reported as good in 20 participants (66.67%), excellent in 9 (30%), and fair in 1 (3.33%). Twenty-four participants had no recorded complications. Superficial infection occurred in 2 participants; deep infection, foot drop, iatrogenic fracture, and dislocation were recorded in 1 participant each. [Table 3]

Table 1: Baseline characteristics of the study participants (N=30)

Characteristic	n (%)
Age 21–25 years	4 (13.33%)
Age 26–30 years	4 (13.33%)
Age 31–35 years	7 (23.33%)
Age 36–40 years	7 (23.33%)
Age 41–45 years	3 (10%)
Age 46–50 years	5 (16.68%)
Male	24 (80%)
Female	6 (20%)
Hypertension	6 (20%)
Diabetes mellitus	5 (16.67%)
Ficat-Arlet stage III	12 (40%)
Ficat-Arlet stage IV	18 (60%)

Table 2: Serial Modified Harris Hip Score functional components

Outcome	Preoperative	6 weeks	12 weeks	24 weeks	48 weeks	Overall P value
Pain subscore	21.0 ± 8.03	26.0 ± 7.24	35.6 ± 6.57	39.86 ± 3.01	40.93 ± 1.72	<0.0001
Limp subscore	4.23 ± 2.58	6.6 ± 1.52	8.9 ± 1.40	10.5 ± 1.14	10.7 ± 0.92	<0.0001
Support subscore	4.8 ± 0.61	9.67 ± 1.92	10.07 ± 1.72	10.73 ± 1.01	$10.87 \pm 0.73^\dagger$	<0.0001
Distance walked subscore	4.5 ± 1.59	10.01 ± 1.40	10.4 ± 1.22	10.7 ± 0.92	10.9 ± 0.55	<0.0001
Stair-climbing subscore	1.5 ± 0.82	2.87 ± 1.08	3.47 ± 0.90	3.6 ± 0.81	3.8 ± 0.61	<0.001
Socks-wearing subscore	1.07 ± 1.01	2.87 ± 1.00	3.8 ± 0.61	3.93 ± 0.37	4.0 ± 0.01	<0.001
Sitting subscore	1.16 ± 1.59	3.73 ± 0.98	4.13 ± 1.01	4.67 ± 0.76	4.8 ± 0.61	<0.001
Public-transport subscore	0.06 ± 0.25	0.46 ± 0.50	0.73 ± 0.45	0.90 ± 0.31	0.97 ± 0.18	<0.001

Table 3: Other clinical outcomes and postoperative events

Outcome	Preoperative	Postoperative	Reported P value / note
Range of movement	$60\text{--}100^\circ$: 20; $101\text{--}150^\circ$: 9; $151\text{--}200^\circ$: 1; $>200^\circ$: 0	$60\text{--}100^\circ$: 0; $101\text{--}150^\circ$: 0; $151\text{--}200^\circ$: 21; $>200^\circ$: 9	<0.001
Limb-length discrepancy	Yes: 26; No: 4	Yes: 3; No: 27	<0.001
Flexion deformity	14	0	-
Adduction deformity	16	0	-
Abduction deformity	3	0	-
Rotational deformity	3	0	-
Postoperative HHS grade	—	Fair: 1 (3.33%); Good: 20 (66.67%); Excellent: 9 (30%)	-
Postoperative complications	—	Superficial infection: 2; Deep infection: 1; Foot drop: 1; Iatrogenic fracture: 1; Dislocation: 1; No complication: 24	-

DISCUSSION

This prospective observational study documented progressive functional recovery during the first 48

postoperative weeks after uncemented THR in young adults with advanced AVN of the femoral head. Improvements were seen across MHHS domains reflecting pain, gait, support, walking distance, stair

climbing, dressing-related activity, sitting, and use of public transport. By the postoperative assessment used for Harris Hip Score grading, most participants were classified as having good or excellent outcomes. The study population was predominantly male, consistent with the male predominance reported in several comparable series of uncemented THR for AVN.^[9,11-14] Age distributions varied among these studies, reflecting differences in recruitment and case mix. The present cohort included Ficat-Arlet stage III and IV disease only, with stage IV accounting for 60%, indicating that the functional outcomes were assessed primarily in advanced disease.

The pattern of serial improvement was broadly comparable with that reported by Reddy MR et al.^[11] In that study, pain, limp, support, walking distance, stair-climbing, socks-wearing, and sitting components also improved after THR. Absolute scores differed at some early time points, but both cohorts demonstrated continued recovery through the available follow-up. Because the studies were not directly compared statistically, these between-study differences should be interpreted descriptively rather than as evidence of superiority.

The observed recovery is consistent with the rationale for uncemented fixation in younger patients. Uncemented implants rely on press-fit stability and subsequent biological ingrowth, and porous-coated designs were developed to improve implant-bone fixation without cement. In the present study, the functional gains were accompanied by improved range of movement and a marked reduction in limb-length discrepancy. Postoperative complications were uncommon in the reported cohort, although infection, foot drop, iatrogenic fracture, and dislocation were recorded and remain clinically relevant adverse outcomes.

The study has several limitations. It was a single-centre, convenience-sampled cohort with a small sample size and no cemented or non-operative comparison group. Follow-up was limited to approximately 12 months, so implant survivorship and longer-term revision outcomes could not be assessed. These limitations restrict generalisability and preclude comparative claims regarding the superiority of uncemented THR over alternative treatments.

CONCLUSION

Uncemented total hip replacement was associated with progressive improvement in pain-related and activity-related hip function over 48 weeks in young adults with Ficat-Arlet stage III or IV avascular necrosis of the femoral head. Serial MHHS components, range of movement, and limb-length discrepancy improved after surgery, and most participants were graded as having good or excellent postoperative hip function. These findings support favourable short-term functional recovery after uncemented THR in this cohort, while longer-term

and comparative studies are needed to establish durability and relative effectiveness.

Declarations

Ethics approval: Approved by the Parul University Institutional Ethics Committee for Human Research (PUIECHR). Approval number: [PUIECHR/PIMSR/00/081734/6309].

Consent to participate: Written informed consent was obtained from all participants.

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REFERENCES

1. Rashid MM, Masud MH, Alam MJ, Islam MS, Hasan MZ, Hossain MZ, et al. The clinical and radiological outcome of uncemented primary total hip arthroplasty in case of AVN of femoral head in middle age group. *International Surgery Journal*. 2022;10(1):39. doi:10.18203/2349-2902.isj20223589
2. Vardhan H, Tripathy SK, Sen RK, Aggarwal S, Goyal T. Epidemiological Profile of Femoral Head Osteonecrosis in the North Indian Population. *Indian J Orthop*. 2018;52(2):140–6. doi:10.4103/ORTHO.IJORTHO_292_16 PubMed PMID: 29576641.
3. Shigemura T, Nakamura J, Kishida S, Harada Y, Ohtori S, Kamikawa K, et al. Incidence of osteonecrosis associated with corticosteroid therapy among different underlying diseases: prospective MRI study. *Rheumatology (Oxford)*. 2011;50(11):2023–8. doi:10.1093/RHEUMATOLOGY/KER277 PubMed PMID: 21865285.
4. Mont MA, Pivec R, Banerjee S, Issa K, Elmallah RK, Jones LC. High-Dose Corticosteroid Use and Risk of Hip Osteonecrosis: Meta-Analysis and Systematic Literature Review. *Journal of Arthroplasty*. 2015;30(9):1506–1512.e5. doi:10.1016/j.arth.2015.03.036 PubMed PMID: 25900167.
5. Liu N, Zheng C, Wang Q, Huang Z. Treatment of non-traumatic avascular necrosis of the femoral head (Review). *Exp Ther Med*. 2022;23(5):321. doi:10.3892/ETM.2022.11250 PubMed PMID: 35386618.
6. Cehelyk EK, Stull JD, Patel MS, Cox RM, Namdari S. Femoral Head Avascular Necrosis. *JBJS Rev*. 2023;11(6). doi:10.2106/jbjs.rvw.23.00014 PubMed PMID: 31536264.
7. Bakircioglu S, Atilla B. Hip preserving procedures for osteonecrosis of the femoral head after collapse. *J Clin Orthop Trauma*. 2021;23:101636. doi:10.1016/J.JCOT.2021.101636 PubMed PMID: 34707972.
8. Tukade M. A Study of Uncemented Total Hip Replacement in Various Hip Disorders. *Journal of Contemporary Clinical Practice*. 2024;10:1–7. doi:10.18683/JCCP.2024.1086
9. Rashid MM, Masud MH, Alam MJ, Islam MS, Hasan MZ, Hossain MZ, et al. The clinical and radiological outcome of uncemented primary total hip arthroplasty in case of AVN of femoral head in middle age group. *International Surgery Journal*. 2022;10(1):39. doi:10.18203/2349-2902.isj20223589
10. Botterill J, Khatkar H. The role of hydroxyapatite coating in joint replacement surgery – Key considerations. *J Clin Orthop Trauma*. 2022;29:101874. doi:10.1016/J.JCOT.2022.101874 PubMed PMID: 35515345.
11. Reddy DrMRS, MS DrS, Phad DrP. Study of clinical and functional outcome of total hip replacement in avascular necrosis of femoral head. *International Journal of Orthopaedics Sciences*. 2018;4(1):252–8. doi:10.22271/ORTHO.2018.V4.I1D.38

12. Reddy VB, Chary NB, Nikitha K. Surgical management of avascular necrosis of femoral head in young adults treated with uncemented total hip replacement. *Int J Res Orthop*. 2021;7(6):1166. doi:10.18203/issn.2455-4510.intjresorthop20214183
13. Karimi S, Kumar S, Ahmed F, Khalid A, Farooque U, Shahzeen F, et al. Functional Outcomes of Cementless Total Hip Arthroplasty in Avascular Necrosis of the Hip: A Prospective Study. *Cureus*. 2020;12(8). doi:10.7759/CUREUS.10136 PubMed PMID: 33005548.
14. Singh V, Bhinde S, Patidar A, Jain S, Sk S. Clinical and functional outcome of uncemented total hip replacement in patients with avascular necrosis of femoral head. *Orthopaedic Journal of M P Chapter* [Internet]. 2022. Available from: <https://ojmpc.com/index.php/ojmpc/article/view/154>.