

Original Research Article

EVALUATION OF FUNCTIONAL OUTCOMES IN PRIMARY UNCEMENTED TOTAL HIP REPLACEMENT

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ABSTRACT

Background: Uncemented total hip arthroplasty (THA) stands out as a highly successful and cost-effective orthopedic procedure, establishing itself as the go-to hip reconstruction treatment for adults, primarily by effectively mitigating the severe pain associated with conditions like advanced hip osteoarthritis. The current study has assessed the functional outcomes of an uncemented total hip implantation procedure by using the Harris Hip Scoring method.

Materials and Methods: It was a prospective interventional study carried out in the Department of Orthopedics, Southern Railway Headquarters Hospital in Chennai. The patients were recruited prospectively, treated and monitored. The Harris Hip Score (HHS) was the main outcome measure studied. Although the quantitative data were analyzed descriptively using standard deviation and mean, categorical variables were analyzed based on frequency and percentage.

Results: Among the patients with good outcomes, 1 (50%) participant had a superficial infection, and 1 (50%) participant had a dislocation. Among the patients with fair outcomes, 1 (100%) participant had a sciatic nerve injury. Among the patients with excellent outcomes, 1 (100%) participant had a superficial infection. Prior to surgery, the median Harris hip score was 50 (IQR 44.5, 65.5); three months after surgery, it was 75 (72, 78); six months after surgery, it was 86 (82.5, 88.5); and 12 months after surgery it was (IQR 89, 92). The pre and post-operative follow-up times, as compared to the pre-operative baseline, showed a statistically significant difference as shown at 3, 6 and 12 months (P Value <0.001).

Conclusion: The study concludes that uncemented primary THA yields excellent functional results for indications like avascular necrosis and osteoarthritis, maintaining minimal complication rates when performed by experienced surgeons with adequate follow-up.

Keywords: Total Hip arthroplasty (THA), Prosthetic survival, Harris Hip Scores (HHS), Uncemented total Hip arthroplasty (Uncemented THA).

INTRODUCTION

Over the past few decades, there has been a tremendous change in the way we treat patients with hip arthritis. Conservative treatment of hip osteoarthritis does not prevent disability or provide sufficient pain relief.^[1] Therefore, Sir John

Charnley's invention of the low-friction cemented complete hip replacement in the 1960s marks a turning point in orthopaedic surgery. Additionally, there have been a lot of technical advancements and developments that have led to major advancements and a sharp decline in failure rate.^[2] Uncemented Total hip replacement is considered as one of the

most successful and cost-effective orthopedic surgical procedures. Total hip arthroplasty has been performed on patients with severe hip arthritis to alleviate the pain, improve the stability of the hip joint and restore joint mobility.^[3] The disorders those lead to the development of hip osteoarthritis are trauma, osteonecrosis of the femoral head, congenital dysplasia of the hip, Paget's disease, ankylosing spondylitis and rheumatoid arthritis. Despite major improvements in implant design and cementing techniques, polymethylmethacrylate remains a weak link between the implant-bone interfaces in cemented total hip arthroplasty.^[4] It has been shown by some long-term studies on cemented total hip prostheses that the most critical and common long-term complication is fixation failure of the implant, which is caused by aseptic prosthesis loosening. It has been observed that the rate of loosening of the implant and revision hip arthroplasty is considerably higher in patients under 60 years of age. Research has been sparked by these discoveries in two areas:

1. Fixation by biological in growth.^[5]
2. Modification of femoral stem design centrifugation of cement and improvement in techniques of cementing.^[5-8]

Assessing the long-term results of an operation is crucial for figuring out how durable treatments like total hip arthroplasty (THA) are. In order to determine the functional outcomes following surgery, surgeons and clinical researchers are increasingly using patient-derived outcome scores. It offers a way to compare the outcomes of various surgical techniques and implant designs which might eventually result in modifications of the implant designs and surgical techniques. In this study, the functional outcomes of an uncemented primary total hip replacement were evaluated using the Harris Hip Score (HHS).

MATERIALS AND METHODS

This is a prospective interventional research carried out in the Department of Orthopaedics, Southern Railway Headquarters Hospital, Chennai, from October 2016 to November 2018. A total of 25 patients were selected from patients attending the emergency department and outpatient department, and they underwent uncemented total hip arthroplasty. For all prospective cases, a detailed history regarding the mode and mechanism of injury (in case of trauma) was taken, followed by clinical examination, and these were documented. Follow-up visit was done at three months, six months and one year and occasionally after that. The committee's ethical approval was obtained before the study.

Inclusion criteria

The study's inclusion criteria encompass a wide range of conditions requiring hip intervention, specifically targeting patients diagnosed with hip secondary osteoarthritis, Avascular Necrosis (AVN) of the Head of Femur, and Fracture Non-union of

the Neck of Femur. Other orthopedic conditions included are Perthes' Disease and Dysplasia of the Hip. Furthermore, patients with inflammatory or systemic diseases affecting the hip, such as Rheumatoid Arthritis and Primary Osteoarthritis of the Hip, were eligible. Finally, patients with systemic conditions like Hemoglobinopathies or certain Collagen Diseases (Systemic Lupus Erythematosus - SLE) were also included in the study.

Exclusion criteria

The exclusion criteria for the study ensure that only suitable candidates are enrolled. Patients were excluded if they presented with any active infection located in the hip or elsewhere in the body or if they had a known metal hypersensitivity which could interfere with prosthetic implantation. Those who were deemed medically unfit for surgery or who had a rapidly progressive neurological disease were also excluded due to operative risk or poor prognosis. The study did not include revision cases (patients who had already undergone prior surgery) or those with associated deformities or fractures in other parts of the body that may have complicated the primary procedure or rehabilitation. Finally, any patient who did not want any surgery were excluded.

Sample Size: A total of 25 patients were included in our study. The Sample size was calculated assuming the mean HHS preoperatively as 29.93 ± 9.42 and in the post-operative value as 36.33 ± 0.98 . The post-operative mean HHS score, which yields the largest sample size, was taken for sample size calculation. The other parameters considered for sample size calculation were 90% power of study and 5% alpha error. The following formula was used for sample size calculation, as recommended by Kirkwood BR et al.^[9]

Scoring System: The functional outcome of Uncemented Primary Total hip arthroplasty was assessed by using the Harris hip score (HHS).

Study Method: All patients underwent surgery performed by senior orthopaedic surgeons using the posterolateral approach while the patient was in a lateral position. Demographic data was collected according to a proforma, ensuring full anonymity for all subjects. A clinical examination was also conducted as per the proforma. The functional outcome was assessed using the Harris hip score, with follow-up visits scheduled at 3 months, 6 months, 1 year and periodically thereafter. Post-operatively, all patients were permitted full weight bearing with support starting from the first day and importantly, all patients were walking without support by their three-month follow-up visit.

Statistical Methods: Harris Hip score (HHS) was considered the primary outcome variable. Descriptive analysis was carried out by mean and standard deviation for quantitative variables and frequency and proportion for categorical variables. Data was represented using appropriate diagrams like bar diagrams, pie diagrams and box plots. The mean pre-operative and post-operative HHS scores

were compared using the Paired t-test. One-way repeated measures ANOVA was used to compare HHS values at multiple follow-up intervals. P value < 0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.

RESULTS

The final analysis covered 25 participants in total. The mean age was 53.56 ± 8.74 in the study population, ranging between 30 years to 65 years (95% CI 49.95 to 57.17) [Table 1 and Figure 1].

Table 1: Age distribution in the study population (In Years) (N=25).

Parameter	Mean $\pm$ SD	Median	Min	Max	95% C.I	
					Lower	Upper
Age (in years)	53.56 $\pm$ 8.74	55.00	30.00	65.00	49.95	57.17

There were seven (28%) female participants and eighteen (72%) male participants in the research population [Table 2].

Table 2: Sex distribution in study population (N=25)

Gender	Frequency	Percentage
Male	18	72.00%
Female	7	28.00%

In the study population, 15 (60%) patients were affected on the right side, and 10 (40%) were affected on the left side [Table 3].

Table 3: Side of involvement of the body in Study Population (N=25).

Side of involvement	Frequency	Percentage
Right	15	60.00%
Left	10	40.00%

Within the research population, 10 (40%) participants had avascular necrosis (AVN), 9 (36%) participants had arthritis, 4 (16%) participants had fracture NOF non-union and 2 (8%) participants had ankylosing spondylitis [Table 4].

Table 4: Causative disease in study population (N=25)

Diagnosis	Frequency	Percentage
Avascular Necrosis (AVN)	10	40.00%
Arthritis	9	36.00%
Fracture NOF Non-union	4	16.00%
AnkylosingSpondylitis	2	8.00%

The study population of six people (24%) obtained good results, one person (4%) had medium results, and eighteen people (72%) had excellent results [Table 5].

Table 5: Outcomes in study population (N=25)

Outcome	Frequency	Percentages
Good	6	24.00%
Fair	1	4.00%
Excellent	18	72.00%

Among the study population, 2 (50%) participants had superficial infection, 1 (25%) participant had sciatic nerve injury and dislocation for each [Table 6].

Table 6: Types of complications in the study population (N=4)

Complications	Frequency	Percentages
Superficial infection	2	50.00%
Sciatic Nerve injury	1	25.00%
Dislocation	1	25.00%

Among the people with good outcomes, 1 (50%) participant had a superficial infection, and 1 (50%) participant had dislocation. Among the people with the fair outcomes, 1 (100%) participant had a sciatic nerve injury. Among the people with excellent outcomes, 1 (100%) participant had a superficial infection [Table 7].

Table 7: Comparison of complications across outcomes (N=4)

Complication	Outcome		
	Good (N=6)	Fair (N=1)	Excellent (N=16)
Superficial infection	1 (50%)	0 (0%)	1 (100%)
Sciatic Nerve injury	0 (0%)	1 (100%)	0 (0%)
Dislocation	1 (50%)	0 (0%)	0 (0%)

* No statistical test was used since there were no volunteers in the cell.

The median Harris hip score pre-operative was 50 (IQR 44.5, 65.5), it was 75 (72, 78) in post-operative 3rd month score, it was 86 (82.5, 88.5) in post-operative 6th month score and 91 (IQR 89, 92). Taking pre-operative as baseline, the difference

between pre-operative and post-operative 3rd month, 6th month and 12th month follow-up periods was statistically significant (P value <0.001) [Table 8].

Table 8: The median Harris Hip Score values of the group at several times of follow-up (N=25)

Parameter	Median Harris Hip Score (IQR)	P value (Wilcoxon signed Test)
Pre-operative (N=25)	50 (44.5, 65.5)	(Baseline)
Post-operative 3rd months (N=25)	75 (72, 78)	<0.001
Post-operative 6th months (N=25)	86 (82.5, 88.5)	<0.001
Post-operative 12th months (N=25)	91 (89, 92)	<0.001



Figure 1: X-ray of immediate preoperative and post operative X-rays of the operated Hip. A. PRE OP X-ray. B. IMMEDIATE POST OP X-ray. C. 1 YR POST OP X-ray

DISCUSSION

The participants' ages ranged from 30 to 65 years old (95% CI 49.95 to 57.17) with a mean age of 53.56 ± 8.74 when cemented and uncemented THA were compared. Goyal et al,^[10] observed that the average age of such study patients who had uncemented THA was 59.72 years. This was in line with the findings of our study. Siddique T et al,^[11] reported that the average age of male and female patients was 35.69 ± 5.55 years and 35.72 ± 5.95 years, respectively.

Avascular necrosis of the femoral head was the leading indication for total hip replacement and was found in 10(40%) participants, followed by arthritis in 9(36%) participants. A fractured femur neck with non-union was diagnosed in 4(16%) participants. Ankylosing spondylitis was observed in 2(8%) participants. In the study conducted by Kawalkar AC et al,^[12] 17 (68%) patients had avascular necrosis as the major cause. Next in line were post-traumatic arthritis [3 (12 %)], ankylosing spondylitis [02 (8 %)] and rheumatoid arthritis [3(12%)].

Fifteen (60%) participants had THA on the right side, and 10 (40%) participants had THA on the left side. This was in line with the study results by Saddique T et al,^[11] in which 40 (62%) patients had pathology on the right hip and 25 (38%) had it in the left hip. Similarly Goyal et al,^[10] reported that out of 25 cases, 9 had pathology of the left side (36%), and 16 had right side pathology (64%).

A hip arthroplasty may result in several problems. Two (50%) and one (25%) of the subjects experienced superficial infections and sciatic nerve damage respectively following surgery. The hip dislocation was noted in one subject (25 per cent). Infection is a leading cause of failure following joint replacement surgery. Three cases of femur fracture

and one case of superficial infection that was treated with antibiotics and dressings were included in the Chand P et al. investigations.^[13] Infections of deep periprosthetic joints are difficult to cure. For effective infection removal, two-stage exchange arthroplasty has been the gold standard in recent years.^[14]

The pre-operative/ baseline median Harris hip score was 50 (IQR 44.5, 65.5). Postoperatively, the Harris hip score improved to 75 (72, 78) at 3 months and to 86 (82.5, 88.5) at 6 months. At the end of the study period in the 12th month, the median Harris hip score increased to 91 (IQR 89, 92). These improvements in the Harris hip score were statistically significant across the time period (P Value <0.001), considering pre-operative as a baseline. Six (24%) participants had good outcomes, 1 (4%) had fair, and 18 (72%) had excellent outcomes at the end of follow-up.

Siddique T et al,^[11] found an improvement in Harris Hip score over a 6-month period from bad to fair, which is consistent with the outcomes of our investigation. Similarly, at the end of two years, Haveri SM et al,^[15] observed an improvement in the mean value of Harris hip score from 44 before surgery to 90 after surgery. The mean Harris hip score of the study published by Kawalkar AC et al,^[12] was found to be 93 points (range 76, 96) as compared to the 34 points (range 15, 46) before surgery. Overall, the current study suggests that after uncemented THA, the post-operative outcome has significantly improved among all the participants. Moreover, only a few complications followed after THA. The uncemented THA can be considered a better and safer option for THA.

CONCLUSION

Patients who are or become resistant to medical therapy might benefit greatly from total hip replacement. This helps people of all age to move more freely, regain function and relief in discomfort. We discovered that all participants' functional outcomes had considerably improved after a 12-month follow-up with patients receiving uncemented total hip arthroplasty. Furthermore, the problems that followed THA were only less severe. For THA, the uncemented THA is a superior and safer choice. The goal of uncemented THA is to

avoid aseptic loosening and the challenges that come with revising cemented THAs. This investigation will significantly advance our knowledge of THA-related outcomes. Patients of all ages can benefit from good functional improvement and short-term symptom reduction following uncemented THA.

Limitations: Our study sample size was small which is why we could not find the association of various factors with the final outcome. This might affect the generalizability of the current study. We had limited our investigation to comorbidities, including diabetes and hypertension. However, other unknown comorbidities which we haven't assessed might have influenced the study outcome. Also, our study objectives were confined to functional outcomes, and hence, we haven't assessed the weight-bearing effect following THA. Our study follow-up was for a shorter period of time. Hence, we could not assess the long-term complications related to THA. Hence, uncemented less THA can be considered a better treatment choice for those who suffer from various pathologies of the hip joint. Further studies with bigger groups and prolonged follow-ups are recommended to gain deeper insight into the consequences of uncemented THA in the long run.

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