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Original Article

Orthopaedics Section

Assessment of Functional Outcome and Quality of Life in Patients after Total Hip Replacement in Indian Population: A Prospective Cohort Study

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ABSTRACT

Introduction: Hip osteoarthritis is a major public health issue associated with a considerable loss of Health-related Quality of Life (HR-QoL). However, not all patients achieve the same level of functional improvement after Total Hip Arthroplasty (THA) and it is unclear which factors are associated with it.

Aim: To determine the functional outcome and QoL in patients who underwent Total Hip Replacement (THR) in an Indian set-up.

Materials and Methods: The present prospective cohort study was conducted in the Department of Orthopaedics, Eras Lucknow Medical College and Hospital, Uttar Pradesh, India, from March 2020 to September 2021. A total of 100 patients who underwent THA were included through convenience sampling. Demographic and clinical information, like name, age, gender, Body Mass Index (BMI), duration of symptoms, co-morbidity, Visual Analogue Scale (VAS) score and Western Ontario and McMaster Universities Arthritis Index (WOMAC) scores, were noted from the medical records. A single follow-up of all the patients who underwent THA was conducted to assess the complications, functional outcomes and QoL using VAS score (preoperative and postoperative), WOMAC score (preoperative and postoperative), Harris Hip Score (HHS) (postoperative), Short Form-36 (SF-36) health survey (postoperative) questionnaire. The data was analysed using Statistical Package for the Social Sciences (SPSS) software version 25.0. Continuous variables were analysed using the Wilcoxon signed-rank test for paired data. Correlation assessment was done using Pearson's correlation coefficient for continuous factors and Spearman's correlation coefficient for categorical factors.

Results: The average age of the patients who underwent THR was 58.90±15.93 years, with a range of 17-95 years. There were 72 males and 28 females. The mean VAS score preoperatively was 7.41±1.20, which decreased significantly to 2.93±0.81 in the postoperative follow-up (p-value <0.001). The mean total WOMAC score improvement was 38.51±10.26 (p-value <0.001). The average postoperative HHS was 73.53±16.16, suggesting a good outcome. The average postoperative SF-36 score was 68.89±12.88. A correlation coefficient of 0.21 (p-value=0.033) suggested that the WOMAC score improvement became higher with an increase in follow-up duration. Patients with postoperative complications had a significantly lower WOMAC improvement (r-value=-0.26, p-value=0.0084). It was observed that the follow-up duration (p-value=0.047) and postoperative complications (p-value=0.016) were significant factors of WOMAC score improvement.

Conclusion: Follow-up duration and the presence of postoperative complications were important factors in the functional outcome of patients who underwent THA. Knowledge of these factors can help the clinician to plan the management accordingly while counseling the patients and their relatives regarding any possible adverse outcomes.

Keywords: Harris hip score, Osteoarthritis, Total hip arthroplasty, Visual analogue scale

INTRODUCTION

Hip osteoarthritis is a major public health problem associated with considerable loss of HR-QoL, therapeutic demands and high cost [1]. According to a study, globally, out of the 291 conditions, hip osteoarthritis has been ranked as the 11th highest contributor to global disability and the 38th highest in Disability Adjusted Life Years (DALYs) [2]. THA, also known as THR, has become a routine treatment option for patients with hip osteoarthritis [1,2].

Total hip arthroplasty is an orthopaedic procedure that involves the surgical excision of the head and proximal neck of the femur and the removal of the acetabular cartilage and subchondral bone. An artificial canal is created in the proximal medullary region of the femur and a metal femoral prosthesis, composed of a stem and small-diameter head, is inserted into the femoral medullary canal. An acetabular component, composed of a high molecular weight polyethylene articulating surface, is inserted proximally into the enlarged acetabular space. To achieve successful results, these THA components must be firmly fixed to the bone, either with polymethylmethacrylate cement or, in more recent uncemented designs, through bony ingrowth into a porous coating on the implant, resulting in biologic fixation [3].

According to surveys, the global incidence of THA is projected to increase by 75% in 2025, 129% in 2030 and 284% in 2040. THA occurs slightly more frequently in women compared to men and is more common in individuals aged 45-64 years and 65-84 years [4]. Since its introduction in the 1960s, THA has proven to be an excellent and reliable treatment procedure for the end stages of hip pathology, with satisfactory clinical outcomes at 15-20 year follow-up. Osteoarthritis (OA) is the most common diagnosis leading to THA. Additionally, THA also provides effective management in patients with hip Osteonecrosis (ON), congenital hip disorders and inflammatory arthritis [5].

With advancements in implant designs, materials, fixation techniques and modern operation theater facilities, the outcome of THA has significantly improved. However, not all patients achieve the same level of functional improvement after THA and it remains unclear which factors are associated with these limitations in function [6]. Previously, it was believed that the type of prosthesis and surgical

technique determined the outcome of THA. However, with the advancement of knowledge, it has become clear that various host factors, including age, weight, social status, social support, preoperative functional activity and the underlying disease leading to THA, also play an important role in the functional outcome of THA [7].

In addition to the functional outcome of THA, patient satisfaction in terms of improved HR-QoL is an important indicator to assess the overall success of THA. Numerous studies have demonstrated the effectiveness of THA in improving functional status and reducing pain. However, there has been considerably less research into the patient's perspective of surgical success through the measurement of patient-perceived HR-QoL [8]. This is particularly important as there is evidence where patients experienced little or no benefit from the surgery, but from the surgeon's perspective, the surgery was deemed successful [9].

Limited research provides evidence on the factors affecting the functional outcome and QoL of THR, particularly in India. Therefore, the current study was planned with the aim of assessing the factors affecting the functional outcomes in patients who underwent THR in terms of improvement in the WOMAC score (total). The secondary objectives were to assess hip pain in patients who underwent THR using VAS, evaluate the functional outcomes in patients who underwent THR using HHS and assess the HR-QoL in patients who underwent THR using the SF-36 questionnaire.

MATERIALS AND METHODS

This prospective cohort study was conducted in the Department of Orthopaedics at Eras Lucknow Medical College and Hospital, Lucknow, Uttar Pradesh, India, from March 2020 to September 2021. A total of 100 patients who had undergone THR were recruited using convenience sampling. Ethical clearance was obtained from the institution (ELMC&H/RCell/EC/2021/188) and informed consent was obtained from the patients.

Inclusion criteria: All patients who underwent primary THA and were willing to participate were included in the study.

Exclusion criteria: Patients who underwent revision THR and those unwilling to participate were excluded from the study.

Study Procedure

Data were collected for the 100 patients who underwent THR, including demographic and clinical information like name, age, gender, Body Mass Index (BMI), socio-economic status, duration of symptoms, co-morbidity status, VAS scores and preoperative WOMAC scores from the medical records [10,11].

A single follow-up was conducted for all patients who underwent THR to assess any complications. Functional outcomes were assessed using VAS scores, WOMAC scores (preoperatively and postoperatively), and HHS scores postoperatively [10-12]. Quality of life was assessed using SF-36 scores [13].

The VAS is a psychometric response scale that can be used to assess pain intensity subjectively [10]. The WOMAC is widely used for the evaluation of hip and knee osteoarthritis. It is a self-administered questionnaire consisting of 24 items divided into three subscales: pain (5 items), stiffness (2 items) and physical function (17 items) [11]. The Pain subscale assesses pain intensity during various activities such as walking, using stairs, lying down and standing upright. The stiffness subscale evaluates the level of stiffness experienced after waking up and later in the day. The physical function subscale measures the ability to perform daily activities such as using stairs, getting in and out of a car, doing household chores and engaging in other physical tasks [11].

The HHS consists of four subscales: pain (44 points), function (47 points), absence of deformity (4 points) and range of motion (5 points) [12]. The pain domain measures pain severity, its impact on activities and the need for pain medication. The Function domain consists of daily activities and gait. The absence of deformity subscale considers factors such as hip flexion, adduction, internal rotation, leg length discrepancy and range of motion. Scores on the HHS range from 0 to 100, with higher scores indicating less dysfunction and better outcomes [12].

The SF-36 questionnaire measures eight scales: Physical Functioning (PF), Role Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role Emotional (RE) and Mental Health (MH) [13]. Scores are standardised on a scale of 0 to 100, with 0 representing poor health status and 100 representing excellent health status [13].

STATISTICAL ANALYSIS

The data was compiled and analysed using Microsoft (MS) Excel (R) Office 365, GraphPad Prism 8.4.2 and SPSS software version 25.0. Descriptive statistics were presented as proportions/percentages for categorical variables and as mean and standard deviation for continuous variables. The Wilcoxon signed-rank test was used to analyse continuous variables for paired data. The correlation between functional outcomes (WOMAC score improvement) and variables was assessed using the Pearson's correlation coefficient for continuous factors and the Spearman's correlation coefficient for categorical factors. Multivariate analysis was conducted using a multivariate linear regression model, including the significant factors identified in the univariate analysis. B covariate and p-values were calculated for each independent variable. A p-value of <0.05 was considered statistically significant.

RESULTS

The average age of the patients who underwent THR was 58.90±15.93 years, ranging from 17-95 years. Half of these patients were over the age of 60 years. Out of the total patients, 72 were males and 28 were females [Table/Fig-1].

Demographic data		n
Age in years	≤60	50
	>60	50
Gender	Male	72
	Female	28
BMI (in kg/m^2) Mean±SD		23.06±3.88
Residence	Rural	23
	Urban	77
Socio-economic status [10]	Lower	25
	Middle and upper	75
Co-morbidities (Diabetes, hypertension, etc.,)	Present	46
	Absent	54
Other joint involvement	Yes	44
	No	56
Duration of symptoms (in years) Mean±SD (range)		4.48±3.36 (0-25)
Duration of follow-up (in months) Mean±SD (range)		14.92±9.54 (3-42)
Intraoperative complications	Present	22
	Absent	78
Postoperative complications	Present	17
	Absent	83

[Table/Fig-1]: Demographic data of study participants (N=100).

The average BMI of the patients was 23.06±3.88 kg/m^2. Majority of the patients belonged to middle and upper socio-economic status. Co-morbidity was observed in 46 patients, while other joint involvement was present in 44 patients.

The average duration of symptoms at the time of undergoing THR was 4.48±3.36 years, with a range of 0-25 years. The follow-up duration for most patients was close to a year (14.92±9.54 months), ranging

from 3-42 months [Table/Fig-1]. The most common indication for THR was osteoarthritis (36%), followed by traumatic injury (32%). Cemented hip implant was the most frequently used type of implant in THR (52%). A total of 22 patients reported intraoperative complications, while 17 patients experienced postoperative complications [Table/Fig-1].

The mean preoperative VAS score was 7.41±1.20, which significantly decreased to 2.93±0.81 in the postoperative follow-up. The mean improvement in the VAS score was 4.48±1.51. Some patients had no improvement (VAS score improvement of 0) in pain even after the intervention [Table/Fig-2].

VAS parameters	Preoperative VAS (0-10)	Postoperative VAS (0-10)	p-value
Mean±SD	7.41±1.20	2.93±0.81	
Minimum	4.00	1.00	**<0.001**
Maximum	9.00	4.00	

[Table/Fig-2]: Comparison of preoperative and postoperative VAS scores.
Wilcoxon signed-rank test for paired data was used; The p-value in bold font indicates statistically significant values

The average overall WOMAC score and individual component scores (pain, stiffness, physical function) significantly decreased in the postoperative follow-up compared to the preoperative levels. The mean total WOMAC score improvement was 38.51±10.26 (p-value <0.001) [Table/Fig-3].

WOMAC (Preoperative)	Pain score	Stiffness score	Physical function	Total
Mean±SD	16.62±2.04	6.96±0.86	58.61±5.36	82.19±6.69
WOMAC (Postoperative)	**Pain score**	**Stiffness score**	**Physical function**	**Total**
Mean±SD	5.55±2.43	1.45±0.52	36.68±7.62	43.68±8.09
p-value (Pre vs Post)	**<0.001**	**<0.001**	**<0.001**	**<0.001**

[Table/Fig-3]: Comparison of preoperative and postoperative WOMAC scores between different domains.
Wilcoxon signed-rank test for paired data was used

The average HHS was 73.53±16.16, ranging from 20 to 96, indicating a good outcome [Table/Fig-4].

The assessment of QoL using the SF-36 general health score showed an average score of 68.89±12.88, ranging from 38 to 90 [Table/Fig-5].

Harris hip score for dysfunction (HHS) (0-100)	
Mean±SD	73.53±16.16
Minimum	20
Maximum	96

[Table/Fig-4]: Harris Hip Score (HHS) for dysfunction.

SF-36 general health score (0-100)	
Mean±SD	68.89±12.88
Minimum	38
Maximum	90

[Table/Fig-5]: SF-36 general health score.

A correlation coefficient of 0.21 (p-value=0.033) indicated that as the follow-up duration increased, the WOMAC score improved [Table/Fig-6]. Patients with postoperative complications showed decreased improvement in the WOMAC score (r-value=-0.26, p-value=0.0084) [Table/Fig-7]. On multivariate analysis, the follow-up duration and postoperative complications were found to be significant factors in WOMAC score improvement [Table/Fig-8].

WOMAC improvement	Pearson's r-value	95% CI	R squared	p-value
Age (in years)	-0.11	-0.30 to 0.091	0.011	0.2892
BMI (in kg/m^2)	0.11	-0.086 to 0.30	0.013	0.2678
Duration of symptoms (in years)	-0.1	-0.29 to 0.097	0.01	0.3144
Follow-up duration	0.21	0.018 to 0.39	0.046	**0.033**

[Table/Fig-6]: Correlation between continuous variables and WOMAC score improvement.
Pearson's correlation coefficient for the continuous predictor variables

WOMAC Improvement	Spearman's r-value	95% CI	p-value
Age in years (≤60=0, >60=1)	-0.067	-0.27 to 0.14	0.5084
Gender (F=0, M=1)	0.022	-0.18 to 0.22	0.8309
Residence (Rural=0, Urban=1)	-0.11	-0.30 to 0.096	0.2852
Socio-economic status (Lower=0, Middle and upper=1)	0.069	-0.14 to 0.27	0.4961
Co-morbidity (Yes=1, No=0)	-0.018	-0.22 to 0.18	0.8556
Other joint involvement (Yes=1, No=0)	-0.04	-0.24 to 0.16	0.6941
Intraoperative complication (Yes=1, No=0)	-0.095	-0.29 to 0.11	0.3472
Postoperative complication (Yes=1, No=0)	-0.26	-0.44 to -0.063	**0.0084**

[Table/Fig-7]: Correlation between categorical variables and WOMAC score.
Spearman's correlation coefficient for the categorical variables

Model	Unstandardised B	Standard error	Standardised B	t	p-value	95% CI - Lower	95% CI - Upper
Constant	36.48	1.919	-	19.009	0	32.671	40.288
Follow-up duration months	0.209	0.104	0.194	2.013	**0.047**	0.003	0.416
Postoperative complication	-6.426	2.626	-0.236	-2.447	**0.016**	-11.638	-1.215

[Table/Fig-8]: Multivariate analysis of follow-up duration and postoperative complications with WOMAC score.

DISCUSSION

The present study demonstrated that the follow-up duration and postoperative complications were significant factors that influenced the functional outcome of primary THA. Recovery after a surgical procedure, especially THR, is a critical step in the overall management of patients. Several factors can significantly influence the functional outcome. It has been observed by Păunescu F et al., that age, preoperative function, non surgical associated diseases, obesity, perioperative complications, factors related to the type of prosthesis, postoperative pain and psychological factors may interfere with postoperative recovery and achieving an optimal functional result after hip replacement [14]. The current study showed a similar result in terms of postoperative complications, which is in agreement with the findings of the present study.

A study by Bischoff-Ferrari HA et al., demonstrated that certain factors were associated with an increased risk of poor functional status after logistic regression analysis for sex and age. These factors, in order of importance, included pain in the back or lower extremity, severe pain in the operated hip, poor mental health, more than one common geriatric problem, obesity and less than college education [15]. The current study showed a similar result for complications, which suggested a poor outcome. Nilsdotter AK et al., found that at follow-up, the only difference between the patients and control group in the SF-36 was in physical function, where patients scored worse. Patients also reported worse WOMAC function. Furthermore, 31% of the patients had an improvement of less than 10/100 WOMAC score points for pain and/or function at the final follow-up compared to preoperatively [16].

In a study by Elmallah RK et al., involving 188 THR patients, SF-6D scores significantly improved at all points. The HHS also showed improvements of 38 points at six months, 40 points at one year, 38 points at two years, 39 points at three years and 41 points at five years postoperatively. The improvements in the lower-extremity

activity scale and the HHS were positively correlated (p-value <0.01) with the SF-6D scores at all time points. The authors concluded that SF-6D scores after THA correlate with functional outcomes and have clinical relevance, as demonstrated by their effect size [17]. The current study is in agreement with these findings, showing improved outcomes as the follow-up period increases.

Koutras C et al., conducted a study on general HR-QoL and disease/hip-specific measures, which showed significant improvements in the physical component score (p-value <0.001) and mental component score (p-value=0.05) of SF-12, as well as the EuroQol-5D (p-value <0.0001). The WOMAC global score and its subscales (p <0.00001) also demonstrated improvements. HHS (p-value <0.00001), Oxford Hip Score (p-value <0.001) and University of California, Los Angeles (UCLA) (p-value <0.00001) marked improvements and patient satisfaction was favourable [18]. The current study also found improvements in the WOMAC score, which is consistent with the findings of the aforementioned study.

Weber M et al., observed that the SF-36 physical indexes of the patients compared negatively with normative values but positively with results obtained from untreated subjects with severe hip osteoarthritis. Similar results were detected for the HHS and WOMAC score. The study reported a 96% rate of postsurgical satisfaction. Hip functionality and co-morbidities were identified as the most important determinants of physical measures on the SF-36 [19]. The evidence in this area is highly varied and heterogeneous. Regarding Indian patient subsets, there is limited data available. However, these factors can still be considered in predicting the outcome of THR in the Indian population.

Limitation(s)

The present study was conducted at a single-centre, which limits the generalisability of the findings to the entire population. Additionally, the follow-up was only conducted during the study duration, preventing long-term follow-up. Future studies with a longer follow-up duration should be undertaken to address this limitation.

CONCLUSION(S)

The duration of follow-up and the presence of postoperative complications were identified as significant factors impacting the functional outcome in patients who underwent THA. Understanding these factors can assist clinicians in planning appropriate management, providing relevant guidance and counselling to patients regarding potential adverse outcomes and complications and ensuring timely follow-up to achieve favourable outcomes of THR.

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