IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 25, Issue 3 Ser. 1 (March. 2026), PP 87-93
www.iosrjournals.org

Clinical Evaluation of Functional Outcomes of Patients after Total Hip Replacement

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Abstract
Background: *Total hip replacement involves removal of diseased bone from both femoral and acetabular side and replacing it with mechanical components. It is one of the most successful surgical procedures. It relieves pain and functional disability experienced by patients with moderate to severe osteoarthritis of the hip, improving their quality of life. The success of THR is ability to relieve pain, while maintaining both mobility and stability of the joint. The purpose of this study was to see the outcome of total hip replacement in patients with hip osteoarthritis.* ***Objectives:*** *To determine the outcome of total hip replacement in osteoarthritis of hip in Bangladesh.* ***Materials & Method:*** *This research was a hospital based prospective experimental study and conducted at the department of Orthopedic Surgery, Dhaka Medical College & Hospital. Twenty-eight patients with advanced osteoarthritis (conservative failed stage 3 and stage 4) of hip joints were selected by non-probability purposive sampling according to inclusion and exclusion criteria. All patient were operated with cemented and non-cemented THR prosthesis. Outcome assessment were done by Harris Hip Score (HHS) in pre-and post-operatively and in following 3 consecutives follow up at 6 week, 12 weeks and at 24 weeks. Data analysis was done by SPSS.* ***Results:*** *Mean age of the population was 43.57 ±9.01 SD (range 18-64 years). Among the respondents, 67.9% (n=19) were male and 32.1% (n=9) were female. Main reasons for which THR underwent were AVN (57.14%), Ankylosing spondylitis (17.85%), primary Osteoarthritis (14.29%), Rheumatoid arthritis (10.72%). Pre-operatively mean HHS was in 42.71±9.47 SD & post-operative mean HHS were 87.64±3.49, 89±3.4, 89.75±3.0 SD during 6 weeks, 12 weeks and 24 weeks follow up respectively. In this study overall 57.1% population showed excellent outcome, 39.3% good and 3.6% showed fair outcome and the changes were statistically significant (p value <.0001).* ***Conclusion:*** *The present study revealed significant improvement of outcome in patient performed total hip replacements.*

Keywords: *Total hip replacement, Hip osteoarthritis, Harris Hip Score, Surgical outcome, Functional improvement*

I. INTRODUCTION

Though it was assumed that a disease of old age but it can happen in earlier age [1] and data suggest that, in worldwide its prevalence of symptomatic OA is 9% of men and 11% of women [2] and overall prevalence of self-reported knee and hip OA were 10.5 % and 8.5 % respectively [3]. Osteoarthritis is a multifactorial process in which mechanical factors have a central role and is characterized by changes in structure and function of the whole joint and resulting major cause of pain and disability [4]. OA can be defined by joint symptoms, by structural pathology (e.g. on X-ray), or by the combination of the two [5]. Several treatment modalities have been used but Total Hip Replacement (THR) is one of the striking options which has proven its efficacy [6]. As 'Age is one of the largest risk factors for developing OA, increasing number of aged populations in world will fuel an increasing incidence of OA and demand for THR [7]. The most common condition for which total hip replacement is done is severe osteoarthritis of the hip, accounting for 70% of cases [8]. Total hip replacement (THR) is one of the most successful surgical procedures and has been identified as the "operation of the century" [9]. Over the

past few decades, it been reported as clinically effective in treating pain and disability resulting from late-stage arthritis of the hip [10]. Despite its effectiveness it usually indicated for those patients who are refractory to respond non-surgical management options such as pharmaceutical treatments (e.g., analgesics, anti-inflammatory agents, steroid injections, topical treatments), self-management, patient education, acupuncture, exercise, physical therapy, or manual therapy [11]. In this procedures, replacement of a damaged hip joint is done with an artificial hip prosthesis consisting of an acetabular cup (with or without shell), a femoral stem, and femoral head [12]. Continuing marketing approval for evolving design of implant components, of prosthesis to bone fixation methods (e.g., cemented, cementless, hybrid), of prosthesis femoral head size and of bearing surface articulations (e.g., metal, ceramic, polyethylene) has resulted in a multitude of options for care providers and patients. However, among the various prosthesis fixation methods with or without use of cement is traditionally practiced in Bangladesh. Several studies were underwent in different location to compare this two methods on the on the basis of efficacy and found no conspicuous difference one over another [13]. Nevertheless, studies regarding these topics are very limited. Keeping in mind, the importance of the topics the study was designed to see outcome of total hip replacement.

II. METHODOLOGY

This prospective experimental study was conducted in the Department of Orthopaedic Surgery, Dhaka Medical College Hospital, from January 2018 to December 2019. A total of 28 patients aged 25–70 years, of both sexes with advanced hip osteoarthritis (stage III–IV) indicated for total hip replacement (THR), including primary osteoarthritis and secondary osteoarthritis due to avascular necrosis, ankylosing spondylitis, or rheumatoid arthritis, were consecutively enrolled in this study using non-probability purposive sampling technique. Patients with active hip infection, rapidly progressive neurological disease, or malignant tumors of the femoral head or acetabulum were excluded from this study. Sample size was calculated using the standard formula ($n = z2pq/d2$), yielding a minimum of 28 participants. Institutional Review Board and Ethical Committee approvals were obtained prior to study initiation, and written informed consent was obtained from all participants or their legal guardians. Preoperative evaluation included clinical assessment, radiological templating, anesthetic clearance, and thromboprophylaxis planning where indicated. THR was performed predominantly through the posterior approach using cemented or uncemented components based on bone quality and preoperative planning. Patients were evaluated preoperatively and followed postoperatively at 6, 12, and 24 weeks for wound status, pain, gait, limb length discrepancy, hip stability, and range of motion. Data were collected using a pretested semi-structured questionnaire and checklist. The collected data were analyzed using Statistical Package for Social Sciences (SPSS) software, version-23.0. Descriptive statistics were expressed as mean ± SD, frequency, and percentage, while inferential analyses were performed using chi-square and t-tests, with a p-value <0.05 considered statistically significant. The ethical clearance of this study was obtained from Institutional Review Board (IRB) of Dhaka Medical College, Dhaka, Bangladesh.

III. RESULT

A total of 28 patients who underwent total hip replacement were included in this study. The majority of the patients were aged between 45–54 years 12 (42.9%), followed by 55–64 years, 7 (25.0%). The mean age of the patients was 48.5 ± 6.03 years, with an age range of 25–62 years. Male patients predominated the study population, accounting for 19 cases (67.9%), while females comprised 9 cases (32.1%), as illustrated in (Figure-I). Regarding occupation, businesspersons constituted the largest group 10 (35.7%), followed by homemakers 7(25.0%), service holders 6 (21.4%), and retired individuals 5 (17.9%) (Table-1). Regarding the clinical characteristics and operative details, the hip involvement was almost equally distributed, with the left side affected in 14 patients (50.0%) and the right side in 12 patients (42.9%); bilateral involvement was observed in 2 patients (7.1%). Regarding etiology, avascular necrosis (AVN) was the most common indication for surgery, seen in 16 patients (57.1%), followed by ankylosing spondylitis in 5 patients (17.9%), primary osteoarthritis in 4 patients (14.3%), and rheumatoid arthritis in 3 patients (10.7%). Non-cemented implants were used in the majority of cases 18 (64.3%), whereas cemented implants were used in 10 patients (35.7%). Subarachnoid anesthesia was administered in 18 patients (64.3%), compared to epidural anesthesia in 10 patients (35.7%). The posterior surgical approach was most commonly employed (20 patients, 71.4%), while the lateral approach was used in 8 patients (28.6%), (Table-2) (Figure-II). The comparison of pre-operative and post-operative Harris Hip Scores (HHS) showed that the mean pre-operative HHS was 42.71 ± 9.47, indicating poor functional status. At 24 weeks post-operatively, the mean HHS significantly improved to 89.75 ± 3.00. This improvement was observed statistically highly significant ($p < 0.001$) (Table-3). The comparison of individual HHS parameters before and after surgery showed significant improvement in nearly all functional domains. The pain score increased from 12.50 ± 4.41 pre-operatively to 42.43 ± 1.99 post-operatively ($p < 0.001$). Similarly, significant improvements were noted in limp, support requirement, walking distance, stair climbing, sitting, range of motion, and ability to wear shoes ($p <0.05$). The public transport parameter showed minimal change and did not reach statistical

significance (p = 0.157) (Table-4). Regarding functional improvement, pre-operatively, all patients 28 all (100%) reported severe or moderate pain, whereas post-operatively, all patients 28(100%) reported no or having only slight pain (p < 0.001). Similarly, moderate to severe limp was present in 21 patients (75.0%) before surgery, while no patient had moderate or severe limp after surgery; 19 patients (67.9%) achieved complete absence of limp (p < 0.001). Regarding walking ability, 17 patients (60.8%) were limited to walking ≤2/3 blocks pre-operatively, which reduced to 3 patients (10.7%) post-operatively. Conversely, the proportion of patients able to walk unlimited or ≥6 blocks increased from 11 patients (39.2%) to 25 patients (89.3%) after surgery (p < 0.001). Implant-wise functional outcomes at 24 weeks showed, among the patients (n=10) receiving cemented implants, 1 patient (10%) had fair outcome followed 4(40.0%) achieved an excellent outcome and 5 patients (50.0%) achieved a good outcome. In the non-cemented group (n=18), 12 patients (66.7%) achieved excellent outcome and 6 patients (33.3%) had good outcome. No patient in either group had a poor outcome. The difference in outcome distribution between the two implant types was statistically significant (p < 0.001) (Table-6). According to follow-up HHS scores at different time points, the mean HHS improved progressively from 87.64 ± 3.49 at 6 weeks to 89.00 ± 3.40 at 12 weeks, and 89.75 ± 3.00 at 24 weeks, showing a statistically significant improvement over time (p < 0.001). Regarding the complications, 1 patient (3.57%) in the cemented group experienced a complication, whereas no complication was observed in the non-cemented group. The difference was not statistically significant (p = 0.357).

Table 1. Baseline demographic characteristics of the study patients (n = 28).

	Frequency	
Age group (years)	n	(%)
25–34	3	10.7
35–44	6	21.4
45–54	12	42.9
55–64	7	25
Mean ± SD	-	48.5 ± 6.03
Range	-	25–62
Sex		
Male	19	67.9
Female	9	32.1
Occupation		
Business	10	35.7
Homemaker	7	25
Service holder	6	21.4
Retired	5	17.9

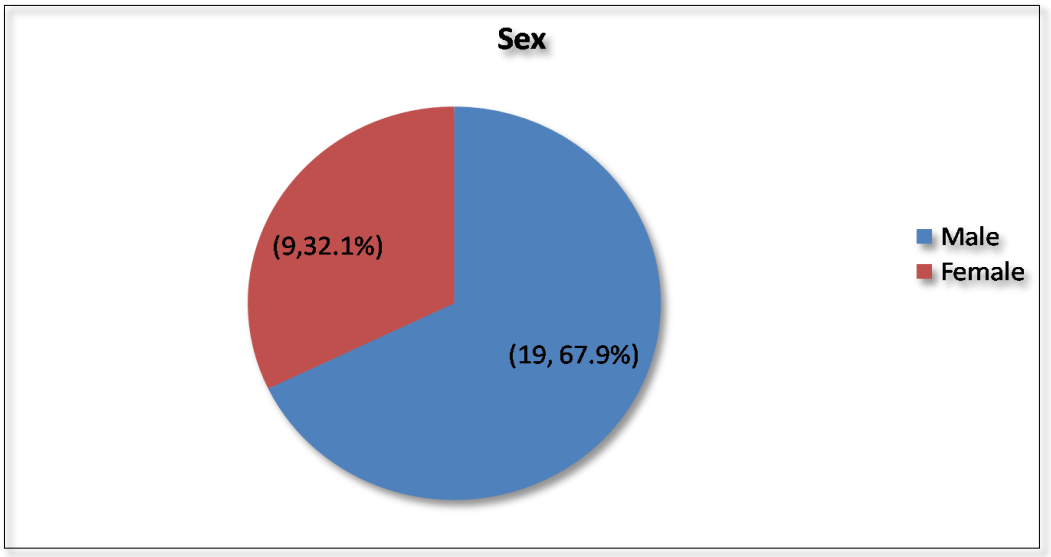

Figure I. Gender distribution of the study patients (n=28).

Table 2. Clinical characteristics and operative details of the study patients (n = 28).

Clinical characteristics and operative details Side involved	n	**(%)**
Left	14	50
Right	12	42.9
Bilateral	2	7.1
Etiology		
AVN	16	57.1
Ankylosing spondylitis	5	17.9
Primary osteoarthritis	4	14.3
Rheumatoid arthritis	3	10.7
Implant type		
Cemented	10	35.7
Non-cemented	18	64.3
Type of anesthesia		
Epidural	10	35.7
Subarachnoid	18	64.3
Surgical approach		
Posterior	20	71.4
Lateral	8	28.6

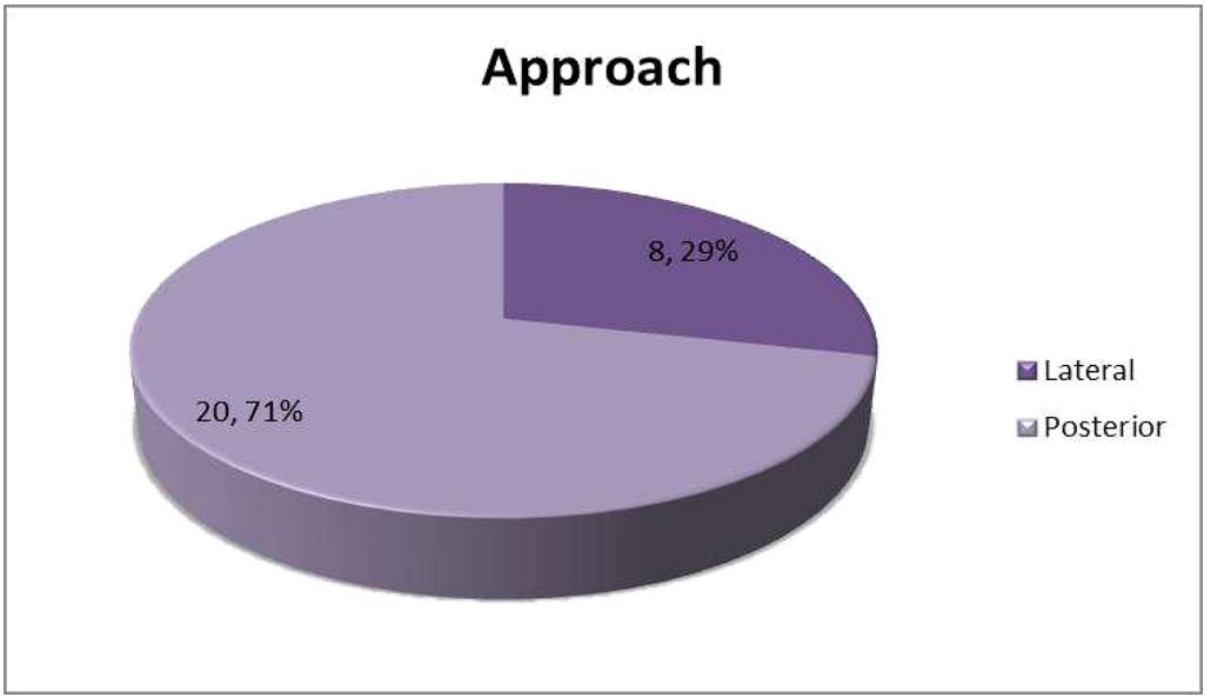

Figure II. Distribution of patients according to approach of operation (n=28).

Table 3. Pre- and post-operative (24 weeks) Harris Hip Score summary (n = 28).

Time point	**Mean ± SD**	**Maximum**	**Minimum**	**p value***
Pre-operative	42.71 ± 9.47	62	18	
Post-operative (24 weeks)	89.75 ± 3.00	93	78	<0.001

Table 4. Comparison of individual Harris Hip Score parameters before and after surgery (n = 28).

Parameter	Pre-op Mean ± SD	Post-op Mean ± SD	p value
Pain	12.50 ± 4.41	42.43 ± 1.99	<0.001
Limp	5.21 ± 2.25	10.04 ± 1.43	<0.001
Support	3.71 ± 2.23	8.43 ± 2.36	<0.001
Walking distance	5.64 ± 2.22	8.64 ± 1.89	<0.001
Stairs	1.36 ± 0.78	2.79 ± 1.00	<0.001
Sitting	2.89 ± 1.20	3.86 ± 1.46	0.003
Range of motion	3.46 ± 1.14	4.39 ± 0.50	0.001
Shoes	1.29 ± 0.98	3.36 ± 0.95	<0.001
Public transport	0.82 ± 0.39	0.89 ± 0.32	0.157

p-value is calculated by related samples Friedman's Two-Way Analysis of Variance by Ranks, where $p<0.05$ considered as the level of significance.

Table 5. Functional improvement categories before and after surgery (n = 28).

Functional domain	Pre-operative n (%)	Post-operative n (%)	p value†
Severe/Moderate pain	28 (100)	0	<0.001
No or slight pain	0	28 (100)	
Moderate/severe limp	21 (75.0)	0	<0.001
No limp	0	19 (67.9)	
Walking ≤2/3 blocks	17 (60.8)	3 (10.7)	<0.001
Unlimited/6 blocks	11 (39.2)	25 (89.3)	

Table 6. Harris Hip Score grading and implant-wise outcome at 24 weeks (n = 28).

Grade	Cemented (n=10)	Non-cemented (n=18)	p-value
Poor	0(0%)	0(0)	<0.001
Fair	1(10%)	0(0)	
Good	5(50%)	6(33.3)	
Excellent	4(40%)	12(66.7)	

Chi-square test was performed to compare the group outcomes, where <0.05 was considered as the level of significance with 95% CI. % Indicates percentage within column.

Table 7. Follow-up outcomes and complications (n = 28)

Follow-up outcomes:	Mean ± SD	p-value
HHS at 6 weeks	87.64 ± 3.49	<0.001
HHS at 12 weeks	89.00 ± 3.40	
HHS at 24 weeks	89.75 ± 3.00	
Complications:		
Cemented(n=10):	n (%)	0.357
Yes	1 (3.57%)	
No	9(32.1)	
Non-cemented (n=18).		
Yes	0(0%)	
No	18(64.2)	

p-value is calculated by related samples Friedman's Two-Way Analysis of Variance by Ranks, and Fisher's Exact test where $p<0.05$ considered as the level of significance.

IV. DISCUSSION

Osteoarthritis (OA) is the most common form of arthritis affecting the hip joint, and total hip replacement (THR) is a well-established and effective surgical intervention when conservative management fails, providing significant pain relief and improvement in function and quality of life [14]. With increasing life expectancy, the prevalence of osteoarthritis continues to rise, leading to a growing demand for hip replacement surgery. The aging

process is also associated with osteoporosis, further increasing the need for THR in patients with advanced hip osteoarthritis [15]. Advances in implant design, fixation methods (cemented, cementless, and hybrid), and femoral head sizes have contributed to improved surgical outcomes [16]. Although THR is widely practiced in Western countries, its use is increasing in Bangladesh; however, local outcome data remain limited. This study was therefore designed to evaluate the outcome of THR in patients with hip osteoarthritis in a tertiary care hospital. In the present study, males constituted 67.9% of the study population, while females accounted for 32.1%. Sex-related differences in osteoarthritis prevalence and severity have been documented, with women generally experiencing more severe disease, particularly in the knee joint [17]. Although women show a higher prevalence of knee and hand osteoarthritis after 50 years of age, evidence regarding sex differences in hip osteoarthritis remains inconsistent [18]. Despite similar clinical presentation between sexes, differences in symptom severity and healthcare-seeking behavior may influence surgical uptake. A higher proportion of male patients undergoing THR has also been reported in other regional studies [19]. The mean age of patients in this study was 48.5 ± 6.03 years. Osteoarthritis is a classic age-related disorder, and although hip OA is less prevalent than knee OA, it remains a significant cause of disability in older populations [20]. A systematic review demonstrated a clear association between increasing age and the prevalence of primary hip OA [21]. Population-based studies have shown that the prevalence of symptomatic hip OA increases substantially with advancing age [22]. Regarding laterality, left hip involvement was observed in 50% of cases, right hip involvement in 42.9%, and bilateral involvement in 7.1%. Previous literature indicates no consistent predilection for involvement of either hip, and side-to-side differences are considered clinically insignificant [23]. Avascular necrosis (AVN) was the most common etiology of end-stage osteoarthritis in this study, followed by ankylosing spondylitis, primary osteoarthritis, and rheumatoid arthritis. Similar etiological patterns have been reported in South Asian populations, where secondary osteoarthritis due to AVN is a leading indication for THR [24]. This differs from Western literature, where primary osteoarthritis predominates, and suggesting epidemiological variation between Asian and Caucasian populations [25]. Both cemented and non-cemented implants were used in this study, with regional anesthesia administered in all cases. The choice of anesthesia has been shown to influence perioperative outcomes, with regional techniques offering potential advantages over general anesthesia [26]. However, anesthetic selection is often based on clinical judgment, and uniformity in practice is uncommon. Functional outcomes assessed using the Harris Hip Score (HHS) demonstrated significant improvement following surgery. Nearly all functional domains showed marked postoperative improvement, except for public transport use. The significant increase in mean HHS at 24 weeks confirms the effectiveness of THR in relieving pain and restoring function in patients with advanced hip osteoarthritis [27]. Both cemented and cementless techniques yielded favorable outcomes. Cementless THR has been shown to provide excellent functional results, particularly in younger and more active patients [28]. In the present study, postoperative improvement was evident across pain, gait, functional activity, and range of motion domains. Based on HHS grading, the majority of patients achieved excellent or good outcomes, with only a small proportion demonstrating fair results. Comparable outcome distributions have been reported in regional a study evaluating THR outcomes [29]. Serial follow-up demonstrated a continuous and statistically significant improvement in HHS at 6 weeks, 12 weeks, and 24 weeks postoperatively, indicating progressive functional recovery. Similar longitudinal improvements have been documented in a previous study assessing functional outcomes after THR [30]

Limitation of the study:

This study had several limitations. The duration of the study and the follow-up period were relatively short compared with other published series, and the sample size was small. Surgical procedures were performed by different surgeons, which may have introduced variability in operative technique. A complete third-generation cementing technique was not uniformly applied in all cases, and implants from different manufacturers were used, leading to heterogeneity in implant characteristics. Owing to these limitations in time and sample size, the findings of this study may not accurately reflect the overall incidence, patterns, or outcomes of total hip replacement at the national level.

Conflict of interest: None declared
Funding: self

V. CONCLUSION & RECOMMENDATION

THR is a very effective method of treatment of advanced osteoarthritis of hip joints. Following replacement patient have shown significant improvement in the range of motion, incapacitating pain relief and functional activities. THR should be adopted as a gold standard treatment for advanced osteoarthritis. Further prospective studies with a larger sample size and a longer follow-up period are recommended to provide more robust and generalizable evidence. Multicenter studies involving different institutions and geographical locations should be considered to better represent the broader population. As outcome evaluation in the present study was

limited to 24 weeks postoperatively, late complications such as implant loosening and periprosthetic fractures could not be assessed; therefore, future research should incorporate long-term follow-up to comprehensively evaluate functional outcomes and late postoperative complications.

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