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Original Article

The Functional Outcome of Total Hip Replacement in Patients with Osteonecrosis of the Femoral Head: Study from a Tertiary Care Centre

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ABSTRACT

Objective: To assess the functional outcome of total hip replacement in patients with osteonecrosis of the femoral head.
Study Design: Prospective, Observational.
Place and Duration of Study: Department of Orthopedic surgery, Jinnah Postgraduate Medical Centre, Karachi Pakistan, from Jun to Dec 2019.
Methodology: All patients aged 30-60 years of either gender presenting with osteoarthritis of unilateral hip joint were recruited for the study. The functional outcome was assessed at the end of 3 months of surgery. Statistical Package for Social Sciences version 26 was used to perform data analysis.
Results: A mean age of the patients was 45.82±9.13 years. Majority of the patients were males, 18(55%) and 22(45%) were females. Mean Body Mass Index of the patients was 26.83±5.26 Kg/m2. There were 31(77.50%) patients with no pain and normal function was found in 15(37.50%) patients. Satisfactory outcome was found in 15(37.50%) patients.
Conclusion: The current study reported that the functional outcome was satisfactory in approximately two-fifth of the population with osteonecrosis of the femoral head in our setting.

Keywords: Femoral head, Functional outcome, Osteonecrosis, Total hip replacement.

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INTRODUCTION

Osteonecrosis of the femoral head (ONFH) is a disabling condition characterized by reduced vascularization to the articular surface of the femoral head, inevitably causing destruction of osteocytes and collapse of the hip joint.[1] The hip joint which is composed of the head of the femur and the acetabulum of the pelvic bone, has a pivotal role in balancing the body weight through different activities. The head of the femur is richly supplied by many vascular sources which when compromised lead to osteonecrosis of the femoral head also known as avascular necrosis.[2]

Patients with osteonecrosis are generally adults who are in their mid-thirties and forties. Certain ONFH associated risk factors include long-term steroid use, smoking, alcohol consumption, and hip trauma.[2,3] Other possible causes for osteonecrosis include slipped capital femoral epiphysis (SCFE), hyperbaric conditions, and various autoimmune diseases including systemic lupus erythematosus (SLE).[4-6]

The disease is usually progressive and may lead to loss of joint space and secondary osteoarthritis with resultant irreversible degenerative joint disease with loss of mobility at the hip joint if no intervention is done.[5] In the United States, the condition affects about 20,000 people, annually.[6] However, the exact prevalence of the disease is not known.

There are several pharmacological and non-pharmacological treatment available depending upon the duration of illness at the time of diagnosis. Treatment options such as anticoagulants, bisphosphonates, shockwave therapy, or hyperbaric oxygen are recommended for early-stage disease.[7-8] Whereas joint-preserving surgeries including the core decompression and bone grafting procedures and joint-replacing surgeries are reserved for advanced cases which do not respond to non-pharmacological treatments. Total hip arthroplasty or hip replacement remains the treatment of choice for a more advanced disease that is refractory to non-surgical treatment options. However, certain studies show contradictory findings reporting less positive long-term outcome of

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total hip arthroplasty in patients with osteonecrosis of femoral head.[9]

Hence, the management and treatment of osteonecrosis of the femoral head remains a therapeutic dilemma for the surgeons even today. Moreover, due to scarcity of local literature on the matter, there is currently no consensus about the optimum treatment option for ONFH. Therefore, the current study was planned and conducted considering that the existing literature was either outdated or had multiple design flaws.[10] The current study was a prospective analysis of patients who presented with advanced osteonecrosis of the femoral head and underwent total hip replacement surgery. The postoperative functional outcome was studied and presented to report the success of THR surgery in our setting.

METHODOLOGY

A prospective, study was conducted at the department of orthopedic surgery, Jinnah Post-graduate Medical Centre, Karachi between Jun to Dec 2019. After obtaining ethical approval from the Institutional Review Board (IRB) with reference number F.2.81/2019GENE/3964, the participants were enrolled in the study using the non-probability convenience sampling technique. By using W.H.O sample size calculator using frequency of Post THR normal function (37.28%),[11] Confidence Level 95%, then the estimated sample size was n=40 patients.

Inclusion Criteria: patients with Osteonecrosis of the femoral head. Unilateral hip involvement. Patients with chronic symptoms (> 6 months).

Exclusion Criteria: Patients with multiple comorbidities, aged above 60 years with associated deformity of the hip joint, bilateral hip involvement, infection involving the hip joint, recent history of surgery, and those with acute symptoms of less than six months were excluded from the study.

Informed verbal and written consent were obtained from all study participants after the purpose of the study, the procedure and the surgery, risk and benefits involved were explained. Patients were labelled as a case of osteonecrosis of the femoral head if they presented with any two or more of the following symptoms: i) sharp catching pain, ii) pain radiating to buttock, iii) limping on walking, and iv) the need of support for climbing stairs. The diagnosis was confirmed on MRI showing a crescentic signal change with a well-defined distinct border and a distinct low-signal line on T1-weighted images that outlines the necrotic lesion.

All patients with osteonecrosis of the femoral neck were scheduled for total hip replacement surgery. All the surgeries were performed by a single consultant having more than five years of post-fellowship experience and were assisted by the same two surgical residents. This was done to minimize biases.

The functional outcome was defined as satisfactory or unsatisfactory based on the patient's response to visual analogue scale and range of motion after three months of surgery. Perception of pain was measured on visual analogue scale score. It is a validated and subjective tool to measure the perception of pain. Scores are documented by a handwritten mark on a 10 cm line representing a range of pain perception between "no pain" and "worst pain".[12,13] Normal function range of motion was regarded as range between 80-100° on the goniometer. Patient's functional outcome was labelled as "satisfactory" when the pain score was between 0-3 indicating "no pain" and the participant had normal function range of motion after 3 months of surgery.

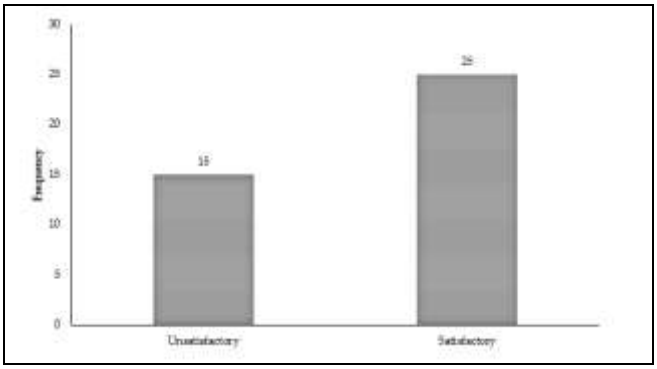

Figure: 3 month postoperative pain perception among study patients

Data was analyzed on SPSS version 26. All continuous data including the age, height, weight, BMI, and duration of illness was presented as Mean±standard deviation. For categorical variables, frequency and percentages were used. These variables included, the gender, functional outcome i.e., pain and normal function, and smoking status of the participants. Post stratification, chi square test was applied. The *p*-value ≤0.05 was considered as significant.

RESULTS

The mean age of the patients was 45.82±9.13 years. Most of the patients were females 22(45%) and

18(55%) were males. The mean BMI of the patients was 26.83±5.26Kg/m2. Almost one-half of the study population had a smoking habit and 22(55%) patients had diabetes mellitus type-2. The sociodemographic characteristics of participants are presented in Table-I. Upon assessing the pain, three months postoperatively, it was found that 31(77.50%) patients had no pain on Visual Analogue Scale (VAS). Similarly, 15(37.50%) patients had normal range of motion (80 to 100 degree of mobility), at follow-up. Fifteen (37.50%) patients indicated "satisfactory outcome", 3 months after total hip replacement surgery as evident in the Figure. Table-II showed that, no significant association was found between age, gender, smoking status, T2DM, its duration, and body mass index with the functional outcome of the patients.

Table- I Demographic and Clinical characteristics of the Study Population (n=40)

Mean±SD Age in years	**45.82±9.13 (range 35-60)**
Gender	
Male Female	18(55.00%) 22(45.00%)
Mean Height ± SD(m)	1.54±0.06
Mean Weight ± SD (kg)	60.35±5.20
Mean Body Mass Index (BMI in kg/m2)	26.83±5.26
Smoking Status	
Yes No	21(52.50%) 19(47.50%)
Diabetes Mellitus Type 2 (DMT2)	
Yes No	22(55.00%) 18(45.00%)
Mean Duration of Diabetes Mellitus Type 2	4.45±1.10
Duration of Diabetes Mellitus Type 2	
<5 years >5 years	17(42.50%) 5(12.50%)
Functional Outcome at 3- months	
Satisfactory Unsatisfactory	15(37.50%) 25(62.50%)

DISCUSSION

Osteonecrosis of the femoral head is a debilitating disease that if left untreated leads to irreversible damage to the hip joint.[14] The present study found that approximately two fifth of the cases in our setting had a satisfactory functional outcome. There are several surgical and non-surgical treatment options for the treatment of ONFH. However, the majority of the patients present with an advanced stage disease. The total hip replacement surgery is considered as the treatment of choice in patients with advanced stage of ONFH.[15] However, the topic is still open to debate and a standard protocol of management is yet to be established. The current study assessed the functional outcome of the total hip replacement surgery in a cohort of patients with ONFH presented at the Department of Orthopedic Surgery, JPMC, Karachi. We found that almost two-fifth of the study population who underwent THR surgery had a satisfactory outcome. The majority had no pain, three months postoperatively. The current study findings are in accordance with the previous literature. In a systemic review article, over 67 articles on total hip replacement for osteonecrosis were assessed. Johansson revealed that the outcome of THR and the six-year survival rate improved after 1990s as compared with those from earlier years.[16] This indicates that with time, the technique of THR has evolved and the functional outcomes of patients have improved. Advanced biomaterials and better techniques have developed over the last decades resulting in improved functional outcome even in patients with advanced ONFH.

Table-II. Association of Functional Outcome of Total Hip Replacement with demographic variables and risk factors (n=40)

Variables	**Satisfactory (n=15)**	**Unsatisfactory (n=25)**	***p*-value**
Age			
≤45	11(73.3%)	17(68.0%)	0.50
>45	4(26.7%)	8(32.0%)	
Gender			
Male	9(60.0%)	13(52.0%)	0.62
Female	6(40.0%)	12(48.0%)	
Smoking Status			
Yes	11(73.3%)	10(40.0%)	0.04
No	4(26.7%)	15(60.0%)	
Diabetes Mellitus Type 2			
Yes	11(73.3%)	11(44.0%.)	0.07
No	4(26.7%)	14(56.0%)	
Durationof Diabetes Mellitus Type 2			
≤5	9(81.8%)	8(72.7%)	0.50
>5	2(18.2%)	3(27.3%)	
Body Mass Index			
≤30	11(73.3%)	13(52.0%)	0.182
>30	4(26.7%)	48.0%)	

It is estimated that about 8-10 percent of patients experience persistent symptoms after total hip replacement surgery.[17] In our study about 22.5% patients with osteonecrosis of femoral head experienced persistent pain three months postoperatively. Certain risk factors including multiple comorbidities, preoperative anxiety, age, advanced disease, surgeon

technique and infection involving the hip joint all contribute towards the final functional outcome.[18-19] In a study by Rolfson et al., it was reported that patients with co-morbidity had a significantly worse outcome postoperatively in terms of pain 18. In contrast, we did not find a significant association between unsatisfactory functional outcome and diabetes mellitus type-2 – a comorbidity (p=0.07). This could be because the majority of our patients had diabetes for less than or equal to 5 years. Only 5 patients with DMT2 had a duration of illness of more than five years.

Avascular necrosis is a devastating and usually progressive disease which mainly affects younger population. Patients with suspected ONFH should be thoroughly assessed for any direct or indirectly associated risk factors. Prompt diagnosis and management is the key to a good patient outcome.[20] Patients with suspected ONFH should be thoroughly examined and investigated to prevent any delays in the diagnosis and management of the condition.

Many studies have reported that the outcomes of primary hip replacement surgery are not influenced by previous hip joint preserving techniques.[20,21] However, in our study, we excluded all patients who had previous hip surgery.

Current treatment and management protocol for osteonecrosis of femoral head is controversial. There are no standard recommendations on how to deal with a patient presenting with different severity of diseases and their respective functional outcomes. Our study supported the previous findings indicating that total hip replacement (THR) gives satisfactory functional outcome in patients with ONFH. Also, that the outcomes of THR even in a high-risk cohort can be improved with better biomaterial, surgical techniques, and improvised prosthetic designs.

CONCLUSION

The current study indicated that postoperative functional outcome in patients who underwent THR was satisfactory in majority of the patients however; further improvement in surgical techniques, prompt diagnosis, and experienced surgeon can play a huge part in improving the final outcome of patients with ONFH.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MTL & MAK: Data acquisition, data analysis, critical review, approval of the final version to be published.

MA & ZAM: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

BA & AB: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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