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Assessment of factors impacting outcome of primary total hip arthroplasty

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Abstract

Introduction: Hip replacement is one of the most successful surgeries in the clinic for the removal of painful joints. Hip osteoarthritis and femoral head necrosis are the 2 main reasons for hip replacement. Several factors are associated with the outcomes of surgery. Nonsurgical factors include gender, age, body mass index, prosthetic material, and risk factors. Surgical factors are anesthesia, postoperative complications, and rehabilitation. Considering the increasing demand for hip arthroplasty and the rise in the number of revision operations, it is imperative to understand factor-related progress and how modifications of these factors promotes recovery following hip replacement. In this review, we first summarize recent findings regarding crucial factors that influence the outcomes of artificial hip replacement surgery. These findings not only show the time-specific effect for the treatment and recovery from hip arthroplasty in the clinic, but also provide suitable choices for different individuals for clinicians to consider. This, in turn, will help to develop the best possible postoperative program for specific patients.

Material & Methods: Our's is a Cross-sectional study which included 32 individuals both male and female above the age of 20 years. All the patients who had undergone Primary Total Hip Replacement for isolated hip pathologies at our hospital; and all are evaluated for functional outcome using Harris Hip Score Pre-operatively, at 1 month, at 3 months, at 6 months and compared.

Results: In our study there was a statistically significant association between BMI, Waist: Ratio, Comorbidity, Duration of surgery & Age and the outcome, which shows that the outcome is dependent on the BMI, Waist: Ratio, Comorbidity, Duration of surgery & Age of the patients.

Conclusion: With the increasing numbers of patients receiving hip replacements every year, it is important to have a knowledge of the possible factors that may influence the outcomes of surgery in individual patients. However, how the novel findings of the factors are associated with the outcomes of surgery and how the variations should be assessed in different individuals are 2 main reasons for us to summarize the literature, and it is imperative to be aware of these factors for designing personalized therapy for individuals in the clinic.

Keywords: Total hip replacement, Harris Hip Score, Functional Outcome

Introduction

The normal hip joint is subjected to many stresses during daily activities performed by an individual. Since it is one of the major weight bearing joints of the body, its normal function is necessary for peaceful and enjoyable day-to-day life. Avascular necrosis (AVN) of the femoral head is one of the common causes of painful hip in a young adult. The natural course of this disease is one of relentless progression with eventual collapse of the femoral head, followed by secondary osteoarthritic changes in the hip ^[1].

Total hip replacement is a surgical treatment that has helped millions of individuals find relief from the crippling agony that the hip joint causes. It is currently the adult reconstructive hip procedure that is most frequently performed. The achievement of Total Hip Replacement. The benefit of replacement is its capacity to reduce hip joint pathology-related pain while preserving the hip joint's stability and mobility ^[1].

To achieve a new, functional hip joint, surgery is only half the battle; the other half is recuperation. This functional outcome is highly susceptible to a variety of circumstances. Age, preoperative function, disorders connected with non-surgery, obesity, perioperative problems,

factors relating to the type of prosthesis, postoperative discomfort, and psychological issues can all affect how quickly you recover from surgery an optimal functional result [2, 3]. Another important factor, which determines the output quality of functional recovery is the degree and consistency of participation of the patient in the program [4]. Although hip replacement is one of the most successful surgeries in the clinic, many factors (surgical and nonsurgical) influence the outcomes of the surgery. Based on different factors, we report first on nonsurgical factors and surgical factors. Non-surgical factors include gender, age, the type of prosthetic material, longevity, and body mass index (BMI). Surgical factors include anesthesia, the skill of the surgeon, and the postoperative rehabilitation program. In recent years, factor-related progress has been made in the clinic and published in the literature. If factors are manipulated in a suitable way, they can exhibit better expectations for the outcomes of the hip replacement surgery. How these factors influence outcomes under certain conditions has not yet been comprehensively summarized.

We are the first to summarize the recent novel findings regarding factors that likely influence these outcomes. Our review will not only exhibit the time-specific effects of the treatment and recovery of THA in the clinic, it also displays a comprehensive understanding of hip replacement [5].

Materials and Methods

Our's is a Cross-sectional study which included 32 individuals both male and female above the age of 20 years. All the patients who had undergone Primary Total Hip Replacement for isolated hip pathologies at our hospital; who gave consent for follow-up evaluations pre-operatively, at 1 month, at 3 months, & at 6 months and Patients who underwent Revision Total Hip Replacement; patients with infection of hip were excluded. This whole study was carried out at a Single-center (Sri Aurobindo Medical College & P.G. Institute).

Study Plan

After meeting the inclusion and exclusion criteria, 32 eligible patients were included diagnosed with Avascular necrosis of femoral head stage III & IV were admitted and underwent a

standard clinical and laboratory evaluation that includes briefly information about age, sex, address, BMI, clinical history and routine investigation which were done pre-operatively. Information on the patients was also compiled from clinical details and Case files. Pre-operative ROM, deformities and its values were recorded for the study by clinical evaluation or from the hospital case sheets and discharge summaries. Patients' functional outcome was evaluated pre operatively, at 1month, at 3 months, & at 6 months by using modified harris hip score and compared with previous follow up results.

Rationale of Harris Hip Score Evaluation

Pains and functional capacity are the two basic considerations. They constitute the indications for surgery in the vast majority of patients with hip problems, and hence receive the heaviest weighting. In specific cases, correction of deformity or restoration of motion may be of prime importance but such cases are uncommon. Based on this reasoning a point scale with a maximum of 100 points is used with the following maximum possible scores:

- Pain 44
- Function 47
- Range of Motion 5
- Absence of deformity 4
- Total 100

Results and Discussions

This Cross Sectional study was conducted to assess the factors impacting outcome of primary total Hip Arthroplasty done in individuals with Avascular necrosis of femoral head at SAMC & PGI with a study span from 1 April 2021 to 30 September 2022. The results of the study are compared with the known similar studies given in the western literature.

The sample size in our study was 32 patients with a mean age group of 33.44 ± 10.23 years. There were 15 patients (46.9%) in the age group between 21-30 years, 9 patients (28.1%) in the age group between 31-40 years, 5 patients (15.6%) in the age group of 41-50 years, and 3 patient (9.4%) above the age of 50 years. The sample size with mean age group in other studies are given below in table no 23.

Table 1: Comparison of patients according to the age

S. No	Study	Year	Sample Size	Mean
1.	Mattigunta <i>et al.</i> [6]	2021	30	42
2.	Prabhulingareddy Patil <i>et al.</i> [7]	2019	30	43
3.	Kumar, V <i>et al.</i> [8]	2020	20	44
4.	Ugbeye ME, <i>et al.</i> [9]	2020	56	30
5.	Our Study	2022	32	33.44 ± 10.23

There was a significance of age distribution in our study, with the maximum number of patients (36%) in 3rd to 4th decade of life, indicating that the avascular necrosis of femoral head has an early onset in younger individuals rather older patients

indicating it is not an age-related pathology of hip.

The sex distribution in our study was 27 males (84.4%) and 5 females (15.6%) showing predominance of male patients, which is comparable to following studies.

Table 2: Comparison of patients according to the sex

S. No	Study	Year	Sample Size	Male	Female
1	Mattigunta <i>et al.</i> [6]	2021	30	23 (76.7%)	7(23.3%)
2	Prabhulingareddy Patil <i>et al.</i> [7]	2019	30	23 (76.7%)	7(23.3%)
3	Kumar, V <i>et al.</i> [8]	2020	20	8 (40%)	12 (60%)
4	UgbeyeME <i>et al.</i> [9]	2020	56	15 (26.8%)	41 (73.2%)
5	Our Study	2022	32	27(84.4%)	5(15.6%)

There was a right hip predominance involvement out of all 32 patients, where 20 patients (62.5%) had Right hip

involvement and 12 patients (37.5%) had Left hip involvement.

Table 3: Comparison of patients according to the side involved

S. No	Study	Year	Sample Size	Side (%)
1	Mattigunta, <i>et al.</i> [6]	2021	30	Right (34.7%) Left (65%.3)
2	Prabhulingareddy Patil, <i>et al.</i> [7]	2019	30	Right (55.5%) Left (44.4%)
3	Kumar, V <i>et al.</i> [8]	2020	20	Right (35%) Left (65%)
4	Ugbeye ME, <i>et al.</i> [9]	2020	56	Right (63.6%) Left (36.4%)
5	Our Study	2022	32	Right (62.5%) Left (37.5%)

In our study the most common cause of AVN was found to be IDIOPATHIC in 18 patients (72%), followed by STEROID in

4 patients (16%) & then SICKLE CELL ANEMIA in 3 patients (12%), which were compared to other related studies.

Table 4: Comparison of patients according to the etiology

S. No	Study	Year	Sample Size	Probable Cause (%)
1	Mattigunta <i>et al.</i> [6]	2021	30	Idiopathic (70%) Steroid (16.7%)
2	Prabhulingareddy Patil <i>et al.</i> [7]	2019	30	Idiopathic (44%) Steroid (20%)
3	Choudhari P <i>et al.</i> [10]	2021	25	Idiopathic (52%) Steroid (24%)
4	Our Study	2022	32	Idiopathic (71.9%) Steroid (18.8%)

The immediate success of Total hip arthroplasty is determined by the ability of the patient to return to maximum possible level of functional activity. Thus maximum points are given to pain and mobility of patients. Patients with chronic arthritis are incapacitated by pain and restricted motion and thus the relief of these two factors greatly determines the satisfactory outcome of the surgery. Restoration of the biomechanics of the hip is important for the good outcome and longevity of the prosthesis. In all our cases we tried to restore the center of rotation, limb length, medial and vertical offset.

We believed that maintaining considerable activity is important for bone remodeling and osteo integration. Only those activities that do not produce considerable joint load such as swimming, cycling and walking are recommended.

The activities that increase the joint load are cross legged sitting, squatting for toilet purposes and any strenuous physical activity. Pain following Total hip arthroplasty confined to thigh indicates loosening of femoral component and pain in the hip indicates loosening of acetabular component. The functional outcome was assessed in our study by using the modified Harris Hip Score. As per the Harris Hip Score, patients are categorized into 4 groups according to the final score of Harris Hip Score at 1 year follow up

- < 70 - Poor
- 70 – 79 – Fair
- 80 – 89 – Good
- 90 – 100 – Excellent

In our study, the mean total score during preoperative stage was 57.50±7.19 and during postoperative stage was 91.31 ± 3.51. The post operative functional outcome by Harris Hip Score at the end of our follow up study at 6 months was excellent in 25 patients (78.1%), good in 6 patients (18.8%), Fair in 1 patient (3.1%).

Table 5: Functional outcome of our study

<70	Poor (0)	0
70-79	Fair (1)	3.1%
80-89	Good (6)	18.8%
90-100	Excellent (25)	78.1%

Mattigunta, *et al.* [6]. The mean total score during preoperative stage was 32.27±8.11 and during postoperative stage was 92.60± 3.16, with a follow up outcome as described in the

table below.

Table 6: Functional outcome of a recent study

<70	Poor (0)	0
70-79	Fair (0)	0%
80-89	Good (6)	20%
90-100	Excellent (24)	80%

Prabhulingareddy Patil, *et al.* [7] 2019 The mean total score during preoperative stage was 34.61, which improved postoperatively to a mean score of 90.83, with a follow up outcome as described in the table below:

Table 7: Functional outcome of a recent study

<70	Poor (0)	0
70-79	Fair (5)	13.89%
80-89	Good (5)	13.89%
90-100	Excellent (26)	72.22%

Kumar V, *et al.* [8] 2020 The Mean preoperative Harris hip score was 34, ranging from 17-54 which was improved post-operatively to 88 (Range = 45.5 -97), with a follow up outcome as described in the table below.

Table 8: Functional outcome of a recent study

< 70	Poor (0)	0
70-79	Fair (0)	0%
80-89	Good (2)	12%
90-100	Excellent (18)	88%

Bourne *et al.* [11], who studied the outcomes of total hip replacement with insertion of prosthesis without cement in patients who had advanced osteoarthritis, reported pain in the thigh in 27 percent (twenty-seven) of 101 arthroplasties and more than 2 millimeters of subsidence of the femoral component in twenty-five hips. In our study we did not have any cases of subsidence of the implant.

Our study detected no association between pain in the thigh and position of the stem which shows similar results as seen in a study by Matthew J. Kraay, Victor M. Goldberg, *et al.*, pain in the thigh occurred in only 5 percent (five) of the total hip arthroplasties and detected no association between pain in the thigh and the size of the stem [12].

Intra operative peri-prosthetic femoral fractures are becoming increasingly common and are a major complication of total hip replacement (THR). The largest study of intra operative femoral fractures at the time of revision total hip arthroplasty was reported by Meek *et al.* [13] Of 211 consecutive patients, 64 (30%) sustained an intra operative femoral fracture and 147 did not sustain a fracture. In our study we don't came across such complication in any patient.

Konyves and Bannister [14] noted that lengthened limbs were

also associated with lower clinical hip scores. Limb-length discrepancy can result from a poor pre-operative patient evaluation as well as intraoperative technical errors with regard to the level of resection of the femoral neck, the prosthetic neck length, or the failure to restore offset. In our study 3 (12%) patients had limb length discrepancy of them all 3 had excellent functional outcome.

In our Study we found, Limb length Discrepancy in 1 patient (3.1%) & superficial infection in 1 patient (3.1%).

Table 9: Comparison of patients according to the complications

S. No	Study	Year	Sample size	LLD	Foot Drop	Dislocation	Infection	Periprosthetic fracture
1	Mattigunta <i>et al.</i> [6]	2021	30	4(13%)	2 (6.6%)	0	0	0
2	Prabhulingareddy Patil <i>et al.</i> [7]	2019	30	0	2 (6.6%)	1 (3.3%)	2 (6.6%)	0
3	Ugbeye ME, <i>et al.</i> [8]	2020	56	3(5.4%)	1 (1.8%)	1 (1.8%)	7 (12.5%)	5 (8.9%)
4	Our Study	2022	32	1(3.1%)	0	0	1(3.1%)	0

In our study there was a statistically significant association between BMI and the outcome, which shows that the outcome is dependent on the BMI of the patients. Excellent grade was highest in Normal weight patients, while good grade was highest in over weight patients and fair grade was highest in obese patients. Our results are comparable to Chee *et al.* [15] showed that obese patients had a significantly higher rate of complications, including dislocation and infection, in the peri-operative period when compared with patients with a BMI < 30 kg/m². Azodi *et al.* [17] which illustrated an increased hazard ratio (HR) for overweight and obese patients. A similar trend was found in other functional outcome scores. Issa *et al.* [20] reported that Short Form-36 questionnaires (SF-36) and University of California, Los Angeles (UCLA) scores were significantly lower ($p = .001$) in the morbidly obese group [16]. All (Chee *et al.*, Azodi *et al.*, Issa *et al.*, Arsoy *et al.*, McCalden *et al.*) [15, 17-19] studies reported that the difference in pre- vs post-operative HHS in the morbidly obese group was at least comparable to HHS improvement in the non-obese controls.

There is significant relationship of waist: hip ratio with outcome lower the waist hip ratio better is the outcome. In Excellent Outcome, the waist: hip Ratio is lowest.

In our study there was a statistically significant association between comorbidities and the outcome. which shows that outcome is dependent on the comorbidities that means our study shows a declining trend in harris hip score in follow up of comorbid individual when compared with the normal individual which is comparable to E. Lenguerrand, *et al.* [21] that significant difference was found in the two groups between preoperative and postoperative Harris Hip Score. The diabetic patients had a preoperative Harris Hip Score that ranged between 27 and 55 points with a mean of 50.90 points, and the postoperative Harris Hip Score ranged between 56 and 97 points with a mean of 85.25 points. However, the nondiabetic preoperative Harris Hip Score ranged from 27 to 54 points with a mean of 47.95 points, and the postoperative Harris Hip Score ranged between 57 and 96 points with a mean of 86.90 points. Also Comparable to Arias-de la Torre *et al.* [22] which stated that A higher incidence of revision was observed when the number of comorbidities was high as we also encountered two Revision THR in patient of Sickle cell anemia & Acute Kidney Failure.

In A Judge *et al.* [23] which stated that there is no effect of preoperative deformity over post operative oxford hip score which is comparable to our study There was no statistically significant association between deformity and the outcome, which shows that the outcome is independent of the pre

operative deformity.

In Kristian Bjorgul, *et al.* [24] reported that there is significant effect of ASA Grade on the functional outcome in total hip replacement. But in our study it is found that there was no statistically significant association between ASA grade and the outcome, which shows that the outcome is independent of the ASA grade. Our result are not comparable to other studies as there is small sample size and the follow up duration is 6 months.

In our study there is significant effect of duration of surgery on the functional outcome in total hip replacement but only up to the 2 weeks follow up. The patient of third quartile group with duration of surgery 87-110 minutes that is 2 patients (6.25%) reported surgical wound related complains like dehiscence, soakage and pain. Whereas the patients of second and first quartile reported no surgical wound related complains which is comparable to Mark D Orland *et al.* [25] which concluded that Longer surgical durations in THA and TKA are associated with a markedly higher risk of wound complications. Enhancing operating room efficiency through extensive preoperative planning, communication, and practice can reduce the surgical duration. In cases with longer anticipated surgical times, appropriate perioperative measures should be taken to minimize patient morbidity and reduce hospital costs.

Conclusion

1. Total hip Arthroplasty is a well-documented surgical procedure. It relieves pain and functional disability experienced by patients with moderate to severe arthritis of the hip, secondary to AVN and improving their quality of life.
2. With the increasing numbers of patients receiving hip replacements every year, it is important to have a knowledge of the possible factors that may influence the outcomes of surgery in individual patients. However, how the novel findings of the factors are associated with the outcomes of surgery and how the variations should be assessed in different individuals are 2 main reasons for us to summarize the literature, and it is imperative to be aware of these factors for designing personalized therapy for individuals in the clinic.
3. In this review, we made efforts to classify related factors, present them as they occur in different individuals and also the long-term effects of certain factors that may function over years in patients.
4. We have provided an overview of factor-related progress to the scientific community, but also present time-

specific effects to be able to better understand the importance of these factors for hip replacement in the clinic.

5. Excellent results can be expected in patient of younger age and with low BMI & Waist: Hip Ratio, with no comorbidity & shorter Duration of surgery.
6. Restoration of the biomechanics of the hip is important for the good outcome and longevity of the prosthesis. In all our cases we tried to restore the center of rotation, limb length, medial and vertical offset. Though the study was not free of complications, the overall functional and clinical outcome showed excellent results.

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Author's Contribution

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Conflict of Interest

Not available

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