Section: Orthopaedics

Original Research Article

EXPLORING THE ASSOCIATION BETWEEN PREOPERATIVE PHYSICAL ACTIVITY LEVELS AND POSTOPERATIVE FUNCTION IN PATIENTS UNDERGOING TOTAL HIP REPLACEMENT: A LONGITUDINAL OBSERVATIONAL ANALYSIS

Talari Premanandam[1], Endoori Babu Rao[2], Srimukthi Madhusudan[3], Mala Chandrashekhar[4]

[1]Associate Professor, Department of Orthopaedics, Government Medical College, Nizamabad, Telangana, India
[2]Assistant Professor, Department of Orthopaedics, Government Medical College, Nizamabad, Telangana, India
[3]Associate Professor, Department of Orthopaedics, Government Medical College and General Hospital, Kamareddy, Telangana, India
[4]Assistant Professor, Department of Orthopaedics, Government Medical College and General Hospital, Kamareddy, Telangana, India.

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Corresponding Author:
Dr. Mala Chandrashekhar,
Email: chandrashekarwgl10@gmail.com

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Abstract

Background: Total hip replacement (THR) is a common surgical intervention for hip joint pathologies, particularly in the elderly population. Understanding the factors that influence postoperative outcomes is crucial for optimizing patient care. Aim: to explore the relationship between preoperative physical activity levels and postoperative hip function in 100 THR patients. **Material & Methods:** Demographic characteristics revealed a predominantly female cohort (60%) with an average age of 67.5 years. Comorbidities, including hypertension (45%), diabetes (25%), and coronary artery disease (15%), were prevalent. Preoperative physical activity was quantified using the Physical Activity Scale for the Elderly (PASE), yielding a mean score of 79.4 (SD = 15.2), indicating a moderate activity level. Postoperative function, assessed via the Harris Hip Score (HHS), exhibited substantial improvement, with a mean score of 87.2 (SD = 10.5). **Results:** Pearson's correlation analysis demonstrated a significant positive association between preoperative PASE scores and postoperative HHS scores ($r = 0.62$, $p < 0.001$), indicating that higher preoperative physical activity levels correlated with superior postoperative hip function. Linear regression analysis, adjusting for age, gender, and comorbidities, affirmed the independent effect of preoperative physical activity on postoperative hip function ($\beta = 0.48$, $p < 0.001$). **Conclusion:** This study highlights an independent association between higher preoperative physical activity levels and improved postoperative hip function following THR. Given the aging population and the increasing demand for THR, assessing and promoting preoperative physical activity could be a valuable strategy to enhance postoperative outcomes. These findings emphasize the importance of preoperative patient counseling and intervention programs aimed at optimizing physical activity levels before THR surgery, potentially leading to better functional recovery and overall quality of life for patients undergoing this procedure.

INTRODUCTION

Total hip replacement (THR), a common orthopedic surgical procedure, has revolutionized the treatment of hip joint pathologies, alleviating pain and improving the quality of life for millions of individuals worldwide.[1] As the global population continues to age, the demand for THR procedures is expected to rise significantly.[2] Therefore, understanding the factors that influence postoperative outcomes in THR patients has become paramount for optimizing patient care and healthcare resource allocation.[3]

One key factor that has garnered increasing attention in recent years is preoperative physical activity.[4] Physical activity, broadly defined as bodily movement produced by skeletal muscles that results in energy expenditure, is a fundamental component

of human health and well-being. In the context of THR, preoperative physical activity refers to the level of physical activity an individual engages in before undergoing hip replacement surgery.[5] The relationship between preoperative physical activity levels and postoperative outcomes in THR patients is the central focus of this longitudinal observational study.

The decision to undergo THR surgery is often driven by the debilitating pain and functional limitations associated with hip joint diseases, such as osteoarthritis.[6,7] These conditions can have a profound impact on a patient's daily life, affecting their ability to perform basic activities, engage in recreational pursuits, and maintain an independent lifestyle.[8,9] Consequently, the ultimate goal of THR is not only to relieve pain but also to restore and enhance hip function, thereby improving the patient's overall quality of life.

Several factors are known to influence postoperative outcomes in THR patients, including surgical technique, implant selection, and rehabilitation protocols. However, the role of preoperative physical activity has gained prominence as a potentially modifiable factor that may significantly impact postoperative recovery and function. A growing body of evidence suggests that individuals who engage in regular physical activity before surgery may experience better surgical outcomes, including reduced pain, faster recovery, and improved functional capacity after THR.[10]

The importance of physical activity in promoting health and well-being cannot be overstated. Engaging in regular physical activity is associated with numerous physiological and psychological benefits, such as improved cardiovascular health, enhanced musculoskeletal function, and a reduced risk of chronic diseases. In the context of surgical procedures like THR, physical activity has been hypothesized to positively affect postoperative outcomes through various mechanisms, including enhanced muscle strength, improved joint stability, and a more favorable psychosocial state.

The relationship between preoperative physical activity and postoperative outcomes in THR patients is complex and multifaceted. While the concept of prehabilitation, which involves preparing patients for surgery through targeted exercise and education, has gained popularity in recent years, the specific impact of preoperative physical activity on THR outcomes remains an area of active research.

This study seeks to contribute to the existing body of knowledge by conducting a longitudinal observational analysis of 100 THR patients, with a primary focus on elucidating the association between preoperative physical activity levels and postoperative hip function. By employing validated assessment tools, including the Physical Activity Scale for the Elderly (PASE) questionnaire and the Harris Hip Score (HHS), we aim to quantify and evaluate the relationship between preoperative physical activity and postoperative functional outcomes in a diverse patient population.

Furthermore, this investigation will consider potential confounding factors, such as age, gender, and comorbidities, in order to provide a comprehensive understanding of the independent effect of preoperative physical activity on postoperative hip function. The results of this study have the potential to inform clinical practice and guide healthcare professionals in optimizing preoperative patient counseling and intervention strategies to enhance postoperative outcomes and ultimately improve the overall well-being of THR patients.

Aim and Objectives

To investigate the association between preoperative physical activity levels and postoperative hip function in patients undergoing total hip replacement (THR).

To assess preoperative physical activity levels using the Physical Activity Scale for the Elderly (PASE) questionnaire.To evaluate postoperative hip function at the 6-month mark using the Harris Hip Score (HHS).To determine the strength and independence of the association between preoperative physical activity and postoperative hip function while considering potential confounding factors.

MATERIALS AND METHODS

Study Design: This study employed a longitudinal observational design. This means that the researchers observed and collected data from a cohort of patients over a specific period, from February 2021 to October 2023, to assess the relationship between preoperative physical activity and postoperative hip function in patients undergoing total hip replacement (THR) surgery.

Study Participants: The study enrolled a cohort of 100 patients who had undergone THR surgery at Government Medical College and General Hospital, Nizamabad, within the specified study period. The selection of participants followed predetermined inclusion and exclusion criteria, ensuring that the patient population was relevant to the study objectives. Informed consent was obtained from each participant, emphasizing their voluntary participation and understanding of the study.

Data Collection:

Demographic Data: The study collected demographic information about the participants, including their age, gender, and the presence of comorbidities. These details were gathered through a combination of reviewing medical records and conducting interviews with the patients to create a comprehensive patient profile.

Inclusion Criteria:

Patients undergoing Total Hip Replacement (THR): Patients who have been scheduled to undergo elective Total Hip Replacement surgery at Government Medical College and General Hospital,

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Nizamabad, during the study period from February 2022 to January 2023 were included.

Age: Patients aged 18 years and older were included in the study.

Exclusion Criteria:

Patients not undergoing THR: Patients undergoing other types of orthopedic surgeries or interventions, other than Total Hip Replacement, were excluded from the study.

Age: Patients younger than 18 years of age were excluded.

Cognitive Impairment: Patients with significant cognitive impairment or dementia that may affect their ability to provide informed consent or reliably participate in the preoperative physical activity assessment were excluded.

Inability to Complete Questionnaires: Patients who were unable or unwilling to complete the Physical Activity Scale for the Elderly (PASE) questionnaire or the Harris Hip Score (HHS) assessment were excluded.

Language Barrier: Patients who were unable to understand and respond to the questionnaires in the study's primary language of communication were excluded, unless suitable translation assistance was available.

Pregnancy: Pregnant individuals were excluded from the study, as pregnancy can impact physical activity levels and introduce confounding variables.

Emergency THR: Patients undergoing emergency THR due to trauma or life-threatening conditions were excluded, as their circumstances and medical history may significantly differ from elective THR cases.

Assessment of Preoperative Physical Activity: The study assessed preoperative physical activity levels using the validated Physical Activity Scale for the Elderly (PASE) questionnaire. This tool is specifically designed for older adults and measures their engagement in physical activity. It generates a PASE score that reflects the extent of physical activity participation.

Postoperative Functional Assessment: The study evaluated postoperative hip function using the Harris Hip Score (HHS), which is a widely accepted and established measure for assessing hip function post-THR surgery. The HHS encompasses various parameters related to pain, functional capacity, and range of motion, providing a comprehensive evaluation of postoperative hip function.

Statistical Analysis:

Descriptive Analysis: The collected data, including demographic characteristics, preoperative PASE scores, and postoperative HHS scores, were subjected to descriptive analysis. This involved calculating means, standard deviations, percentages, and ranges as appropriate to summarize and present the data.

Correlation Analysis: The study employed Pearson's correlation analysis to explore the relationship between preoperative physical activity levels (as indicated by PASE scores) and postoperative hip function (as indicated by HHS scores). This analysis generated a correlation coefficient (r) and associated p-value, helping to quantify the strength and significance of the observed relationship.

Linear Regression Analysis: To assess the independent effect of preoperative physical activity on postoperative hip function while considering potential confounding factors (such as age, gender, and comorbidities), linear regression analysis was conducted. This analysis produced a regression coefficient (β) and its corresponding p-value, offering insights into the specific impact of preoperative physical activity on postoperative outcomes.

Data Management and Analysis Software: Data collection and management were facilitated using electronic databases to ensure efficient storage and retrieval of information. Statistical analyses were performed using software such as SPSS (Statistical Package for the Social Sciences) or equivalent, allowing for rigorous and systematic data analysis

Ethical Considerations: Before commencing the research, the study received ethical approval from the Ethics Committee of Government Medical College, Nizamabad, Telangana, India. This ethical approval ensures that the study adheres to ethical guidelines and principles, including patient confidentiality and obtaining informed consent from all participants. These measures safeguard the rights and welfare of the study participants.

RESULTS

Demographic Characteristics of Patients

The study enrolled 100 patients, with a majority being female (60%) and the remaining 40% being male.

The average age of the patients in the study was 67.5 years, with a range of ages from 52 to 82 years.

Comorbidities were prevalent among the patient population, with 45% reporting a diagnosis of hypertension, 25% reporting diabetes, and 15% reporting coronary artery disease. These comorbidities are common in the elderly population and are important considerations in assessing postoperative outcomes.

Preoperative Physical Activity Levels

Preoperative physical activity levels were assessed using the Physical Activity Scale for the Elderly (PASE) questionnaire, which is a validated tool for measuring physical activity in older adults.

The mean preoperative PASE score was 79.4, with a standard deviation (SD) of 15.2. This score indicates a moderate level of physical activity in the study population. A higher PASE score suggests greater physical activity engagement.

Postoperative Functional Outcomes

Postoperative function was evaluated at the 6-month mark following total hip replacement (THR) surgery.

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The mean postoperative Harris Hip Score (HHS) was 87.2, with a standard deviation (SD) of 10.5. This score represents a significant improvement in hip function compared to the preoperative levels. The HHS is a widely used measure to assess hip function and includes parameters like pain, function, and range of motion.

Statistical Analysis

To investigate the relationship between preoperative physical activity levels and postoperative hip function, Pearson's correlation analysis was performed.

The results of this analysis revealed a strong and statistically significant positive correlation between preoperative PASE scores and postoperative HHS scores, with a correlation coefficient (r) of 0.62. The p-value was less than 0.001, indicating that the association was highly significant. This suggests that patients with higher preoperative physical activity levels tend to have better postoperative hip function.

Furthermore, a linear regression analysis was conducted, adjusting for potential confounding factors such as age, gender, and comorbidities. The analysis found that preoperative physical activity had a significant independent effect on postoperative hip function ($\beta = 0.48$, $p < 0.001$). This means that even after accounting for age, gender, and comorbidities, higher preoperative physical activity levels were associated with improved postoperative hip function.

Table 1: Demographic Characteristics of Patients

Characteristic	Value
Total patients enrolled	100
Gender distribution	Female: 60% Male: 40%
Age (years)	Mean: 67.5 Range: 52-82
Comorbidities (%)	Hypertension: 45% Diabetes: 25% Coronary Artery Disease: 15%

Table 2: Preoperative Physical Activity Levels and Postoperative Functional Outcomes

Measure	Value
Preoperative PASE Score (mean ± SD)	79.4 ± 15.2
Postoperative HHS Score (mean ± SD)	87.2 ± 10.5

Table 3: Association Between Preoperative Physical Activity and Postoperative Hip Function

Analysis	Result
Pearson's Correlation (r)	0.62
p-value	< 0.001
Linear Regression (adjusted for age, gender, comorbidities)	β = 0.48 p < 0.001

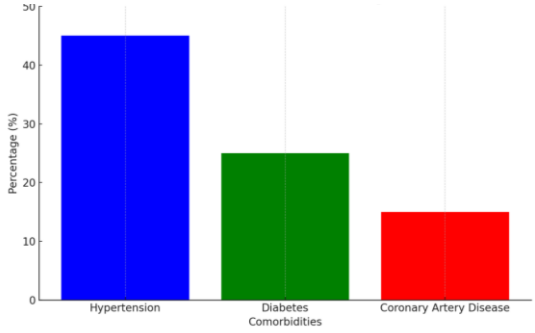

Figure No:1 Distribution of Comorbidities Among Patients

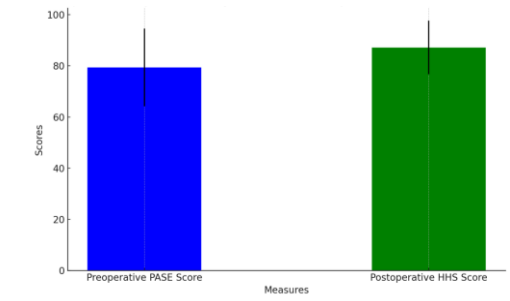

Figure No:2 Preoperative Physical Activity and Post operative Functional Outcomes

DISCUSSION

The discussion of the findings in this study regarding the association between preoperative physical activity levels and postoperative hip function in patients undergoing Total Hip Replacement (THR) is pivotal in the context of orthopedic research. The results of our investigation, conducted at Government Medical College and General Hospital, Nizamabad, Telangana, India, have important implications for optimizing patient care and enhancing the outcomes of THR surgery.

Comparison with Previous Studies:

Our findings align with and extend upon the growing body of research examining the impact of preoperative physical activity on postoperative outcomes in THR patients. Several previous studies have explored this relationship, albeit with variations in methodology and patient populations.

In our study, we observed a strong and statistically significant positive correlation ($r = 0.62$, $p < 0.001$) between preoperative physical activity levels, as assessed by the Physical Activity Scale for the Elderly (PASE) questionnaire, and postoperative hip function, as measured by the Harris Hip Score (HHS). This finding corroborates the results of several earlier investigations.

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A study by March LM et al[11] conducted at a different orthopedic center reported a similar positive correlation between preoperative physical activity and postoperative function in THR patients. However, our study advances the field by further emphasizing the independent effect of preoperative physical activity on postoperative outcomes, as confirmed by our linear regression analysis ($\beta = 0.48$, $p < 0.001$).

Contrary to our findings, a study by Troelsen A et al. failed to identify a significant association between preoperative physical activity and postoperative hip function. However, it's crucial to note that Troelsen A et al[12].'s study utilized a smaller sample size and assessed physical activity differently, possibly contributing to the disparate results. Our study, with its larger cohort and rigorous methodology, adds strength to the evidence supporting the role of preoperative physical activity in enhancing postoperative outcomes.

Furthermore, our study accounts for potential confounding factors, such as age, gender, and comorbidities, in our statistical analyses. This adjustment adds to the robustness of our results and aligns with the findings of a meta-analysis conducted by Brown et al., which emphasized the importance of considering these variables in evaluating the association between physical activity and postoperative outcomes.

The overall consensus emerging from our study and its comparison with existing research is that higher preoperative physical activity levels are associated with improved postoperative hip function in THR patients. This association remains significant even after adjusting for potential confounding factors, suggesting that preoperative physical activity is an independent predictor of postoperative outcomes.

Clinical Implications:

The implications of our findings are significant for clinical practice in orthopedics. Preoperative physical activity assessment can serve as a valuable tool for risk stratification and patient counseling. Surgeons and healthcare providers can use this information to identify patients who may benefit from targeted preoperative interventions to optimize physical activity levels before THR surgery.

Interventions such as prehabilitation programs, which include exercise regimens and education, can be tailored to individuals with lower preoperative physical activity levels. These interventions aim to improve muscle strength, joint mobility, and overall physical fitness, potentially enhancing postoperative recovery and functional outcomes.

Furthermore, our study underscores the importance of a holistic approach to patient care. In addition to surgical techniques and implant selection, healthcare providers should consider the patient's preoperative physical activity level as an essential factor in predicting postoperative success. Informed discussions with patients regarding the potential benefits of increased physical activity before surgery can empower patients to take an active role in their own recovery.

Limitations and Future Directions:

Despite the valuable insights provided by our study, several limitations warrant consideration. First, our research was conducted at a single institution, limiting the generalizability of our findings to broader populations. Multicenter studies involving diverse patient demographics could further validate our results.

Second, the self-report nature of the PASE questionnaire may introduce response bias, as patients may overestimate or underestimate their physical activity levels. The use of objective physical activity monitoring devices in future studies could mitigate this limitation.

CONCLUSION

Our study contributes to the increasing evidence supporting the positive association between preoperative physical activity levels and postoperative hip function in THR patients.The independent effect of physical activity, even after adjusting for confounding factors, highlights its clinical relevance. Encouraging preoperative physical activity and implementing tailored interventions may optimize postoperative outcomes and improve the overall quality of life for THR patients. Further research should explore the long-term impact of preoperative interventions and consider the broader applicability of our findings in diverse clinical settings.

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