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Original Research Article

An Institutional Based Retrospective Study to Compare the Gait, Trendelenburg Test and Functional Outcome between Lateral and Posterior Approaches for Primary Total Hip Arthroplasty (THA)

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Abstract:

Background: When a patient's hip joint is damaged, a Total Hip Arthroplasty (THA) is frequently required. Whether a posterior or lateral surgical approach is preferable has been discussed. This retrospective study was conducted between 1st January 2022 and 31st December 2022 to compare the lateral and posterior approaches to THA regarding postoperative gait patterns, Trendelenburg test results, and functional recovery in 200 patients.

Methods: Two hundred patients were analysed, with the first group being studied using a lateral technique and the second group being studied using a posterior approach. Patients had preoperative, postoperative, and 12-month assessments of gait, Trendelenburg, and functional outcomes. There was a statistical comparison of the two procedures.

Results: The mean BMI for the posterior approach group was 29,1, while the mean BMI for the lateral approach group was 28.6. After surgery and rehabilitation, gait performance analysis suggested a distinct advantage for the posterior approach. One year after surgery, the posterior group's stride length was 97.4 centimetres, while the lateral group's was 94.2. The reduction of stance time during the gait cycle confirms the gait efficacy of the posterior approach. Postoperatively, both groups possessed fewer positive Trendelenburg tests, indicating enhanced hip abductor function. One year after surgery, only 7% of posterior and 11% of lateral patients had positive Trendelenburg tests. The functional outcomes of the Harris Hip Score improved in both groups over time, but the posterior group consistently outperformed the anterior group. One year after surgery, posterior approach patients had a greater Hip Health Score than lateral approach patients, showing superior hip health and function.

Conclusion: This study shows that compared to the lateral method, the posterior technique for THA improves gait, hip muscle function, and hip health more generally. These findings illustrate the importance of considering the patient's outcomes and quality of life while selecting a surgical technique for THA.

Keywords: Gait analysis, Lateral approach, Posterior approach, Surgical approach, Total Hip Arthroplasty, Trendelenburg test.

Introduction

THA has become a standard orthopaedic procedure for treating debilitating hip joint disorders [1]. Osteoarthritis, rheumatoid arthritis, avascular necrosis, and hip fractures are all conditions that can harm the quality of life of their victims. Consequences of these disorders frequently include persistent pain, mobility issues, and a reduced capacity to perform daily tasks [2]. THA can provide patients with pain relief and improved health. THA involves removing diseased or worn-out portions of the hip joint and replacing them with biomechanically identical artificial components [3]. Due to advancements in surgical techniques, implant materials, and rehabilitation protocols, THA has become one of the most successful and regularly performed orthopaedic procedures worldwide.

Objectives

- To compare the mobility patterns of people who underwent THA via lateral versus posterior approaches.
- To compare the Trendelenburg examination results of patients who have undergone lateral versus posterior THA.

- To compare the two surgical procedures in terms of their functional outcomes, including range of motion, pain relief, and patient-reported quality of life.

This study aims to enhance THA surgical techniques and increase postoperative patient quality of life. The relative merits of the lateral and posterior approaches to THA and their possible impact on patient recovery and postoperative care remain a source of contention among orthopaedic surgeons. It aims to help the orthopaedic community and guide clinical decision making with evidence by comparing locomotion, Trendelenburg test outcomes, and functional recovery across multiple methods. Our findings could improve the health and quality of life of individuals with THA

Literature Review

THA is a usual procedure for those with hip joint diseases in order to diminish pain, increase flexibility, and improve patients' quality of life [4]. Two primary surgical procedures have been used for THA, the lateral and posterior procedures. This comparative analysis's significance is highlighted by the essential insights and gaps uncovered by our exhaustive literature review.

Figure 1: Total Hip Arthroplasty [5]

THA Approaches

The lateral approach, also known as the Hardinge approach, involves an incision on the side of the hip. With this approach, the hip joint may be readily accessible, reducing the risk of dislocation. In contrast, the posterior approach involves making an incision in the back to gain access to the joint, which could be less invasive and cause less damage to the surrounding muscles [6, 7].

Even though both techniques have demonstrated effectiveness in THA, orthopaedic surgeons cannot appear to agree on which to employ.

Figure 2: Lateral Approaches Total Hip Arthroplasty[8]

Gait Analysis

Analysing the effectiveness of a THA can be significantly assisted by gait analysis. It has been demonstrated that the gait metrics of patients who had THA surgery improve considerably after treatment [9]. However, slight research has been conducted on how the surgical procedure influences walking patterns. There is no systematic research examining the impacts of various surgical procedures on gait metrics.

Trendelenburg Test

The Trendelenburg test is frequently used to assess the hip abductor muscles, which play a crucial role in maintaining walking balance [10]. A positive Trendelenburg test indicates hip abductor weakness, which may influence the patient's gait. Due to the lack of specific information comparing the results of the Trendelenburg test between lateral and posterior THA techniques, it is difficult to make definitive conclusions regarding the effect of these procedures on hip muscle function.

Functional Outcomes

Functional recovery after THA is characterised by patient-reported quality of life, physical activity, and reduction in discomfort [11]. Multiple investigations have discovered positive functional outcomes for both lateral and posterior approaches.

However, there is a shortage of studies that explicitly compare the efficacy of various methods for active recovery; consequently, doctors need more information to base their decisions on.

Gaps in the Literature

Despite much research on THA, several gaps remain in the existing literature. Few studies have explicitly compared the lateral and posterior techniques regarding gait patterns, Trendelenburg test results, and functional recovery. This type of comparative study significantly facilitates evidence-based decision-making in clinical practice.

In addition, there is not always consistency in the optimal approach to THA in the existing research, which may contribute to variations in surgical techniques and patient outcomes. It is essential to close these knowledge deficits if orthopaedic surgeons are to make considered treatment decisions for their patients. While prior research has demonstrated that both lateral and posterior approaches to THA can be efficient, a systematic comparison has not been performed until now. By measuring gait, Trendelenburg test results, and functional recovery, our research aims to fill these gaps and focus on optimising surgical procedures for THA patients.

Methods

Study Design

This retrospective study will include patients undergoing primary THA at Patna, Bihar Medical College, between 1st January 2022 and 31st December 2022. Retrospective studies are optimal for comparing historical patient data and investigating patterns and outcomes associated with various surgical techniques.

Participants

To maintain a consistent sample, the following inclusion and exclusion criteria were used:

Inclusion Criteria

- Adults between the ages of 18 and 80.
- THA surgery for the first time can be performed from either the side or the back.
- Before and after surgery, gait analysis and Trendelenburg testing results are available as functional outcome measures.

Exclusion Criteria

- Previous recipients of hip surgery
- Patients suffering from multiple weakening conditions.

Due to the study's intended purpose, no additional participants were recruited. Instead, those who met the inclusion criteria were extracted from the institution's data system.

Demographics: Each patient's age, gender, body mass index, and preoperative diagnosis were recorded.

Data Collection

Gait Analysis

Pre-and postoperative gait data were collected (e.g., at three months, six months, and one year). Several locomotion metrics were measured, including stride length, cadence, stance time, and swing time.

Trendelenburg Test Assessment

Before and after surgical procedures, the Trendelenburg test was administered by trained physiotherapists. The hip abductor muscle endurance was evaluated, with either positive or negative results.

Functional Outcomes

Functional outcomes were evaluated utilising the Harris Hip Score (HHS) and the Short Form-36 (SF-

36) Health Survey. These evaluations were conducted before surgery and at predetermined intervals, such as 3, 6, and 12 months. The HHS evaluates hip pain, mobility, and general health, whereas the SF-36 evaluates public health and well-being.

Statistical Analysis

The significance level was set to $p< 0.05$, and was employed to analyse the data. The following statistical methods were employed:

Using descriptive statistics, the mean, standard deviation, and range were utilised to present demographic and initial measurement data.

Between the lateral and posterior approach groups, continuous gait parameters, Trendelenburg test results, and functional outcomes were compared using independent t-tests or Mann-Whitney U tests. To compare categorical variables, Chi-square and Fisher's exact tests were used.

We used repeated-measures analysis of variance (ANOVA) to compare the changes in gait metrics, Trendelenburg test scores, and functional outcomes between the three surgical groups over time.

In subgroup analyses, age, gender, and body mass index were used to investigate potential moderators of surgical method effects on outcomes.

Results

Participant Demographics

Table1: Demographic characteristics of Participants

Characteristic	Lateral approach (n=100)	Posterior approach (n=100)
Age (years), Mean (SD)	63.2 (7.4)	64.8 (6.9)
Gender (Male/Female)	47/53	49/51
BMI, Mean (SD)	28.6 (3.1)	29.1 (2.8)

The Posterior Approach group had a higher average body mass index than the Lateral Approach group. Surgery outcomes may be influenced by body mass index; therefore, this difference must be considered when analysing the data. Notably, the BMIs of the two groups lie within a comparable range, indicating no significant difference in the overall weight of the study's patient population.

Gait Analysis

Table 2: Gait Parameters Comparison between Lateral and Posterior Approaches

Gait Parameter	Preoperative Mean (SD)	3-Month Postop Mean (SD)	6-Month Postop Mean (SD)	1-Year Postop Mean (SD)
Stride Length (cm)	80.5 (6.2)	94.2 (5.9)	96.8 (6.1)	97.4 (6.2)
Cadence (steps/min)	98.6 (8.3)	105.4 (7.9)	106.1 (8.0)	106.7 (7.8)
Stance Time (% gait)	58.3 (4.1)	55.7 (3.9)	55.5 (4.0)	55.2 (3.8)
Swing Time (% gait)	41.7 (4.1)	44.3 (3.9)	44.5 (4.0)	44.8 (3.8)

At all postoperative time points (three months, six months, and one year; $p< 0.05$), patients who underwent THA via the posterior method had greater stride length and cadence than those who experienced the lateral approach. The posterior approach group also demonstrated significantly reduced posture time relative to the gait cycle, indicating increased gait efficiency. The findings suggest a posterior strategy could result in better gait outcomes.

Trendelenburg Test

Table 3: Comparison of Trendelenburg Test Results

Surgical Approach	Preoperative Positive (%)	3-Month Postop Positive (%)	6-Month Postop Positive (%)	1-Year Postop Positive (%)
Lateral	31%	15%	12%	11%
Posterior	29%	10%	8%	7%

In both the lateral and posterior groups, the percentage of patients in a positive Trendelenburg test decreased postoperatively. In contrast to the lateral approach group, the posterior approach group demonstrated superior hip abductor muscle function as measured by a reduced percentage of positive Trendelenburg tests at each postoperative time interval.

Functional Outcomes

Table 4: Functional Outcomes (HHS) Comparison

Surgical Approach	Preoperative Mean (SD)	3-Month Postop Mean (SD)	6-Month Postop Mean (SD)	1-Year Postop Mean (SD)
Lateral	43.7 (8.1)	80.5 (9.2)	87.2 (8.5)	88.6 (8.7)
Posterior	44.2 (7.8)	82.3 (8.6)	89.5 (8.2)	91.1 (8.0)

As evaluated by the Harris Hip Score, functional outcomes improved significantly ($p< 0.05$) across all time points in patients undergoing either surgical method. Notably, the posterior approach group frequently outperformed the lateral approach group, demonstrating superior hip function and health.

Discussion

Our findings significantly affect the optimal surgical strategy for THA. Several of our important observations require additional discussion:

Gait Analysis

The Posterior Approach group had greater stride lengths, higher cadences, and shorter posture periods than the Lateral Approach group. According to these findings, the Posterior Approach may permit greater mobility immediately after surgery, resulting in faster recovery and a return to normal walking patterns.

Trendelenburg Test

The Posterior Approach group had a lower percentage of successful Trendelenburg tests at each postoperative checkpoint. Abductor muscles, essential for sustaining hip stability during walking, are more likely to have survived. This is a significant finding because Trendelenburg's gait indicates hip instability, which can lead to mobility issues and a higher risk of stumbles.

Functional Outcomes (HHS)

Functional outcomes based on the HHS favoured the Posterior Approach group. After a year, they performed higher on both the pre-and postoperative assessments. The study's results suggest that patients who underwent the Posterior Approach experienced an improvement in hip function and general hip condition. When comparing our study's findings to those of others, we find that the Posterior Approach provides comparable benefits in gait, hip muscle function, and functional outcomes. The consistency of our findings contributes to the increasing amount of evidence favouring the Posterior Approach for enhancing patient mobility and quality of life after THA. In contrast, some studies have demonstrated comparable outcomes for both techniques.

Comparison with Existing Literature

Table 5: Comparison with Existing Literature

Aspect of Comparison	Gait Analysis				Trendelenburg Test		Functional Outcomes (HHS)	
	Stride Lengths (p-value)	Cadences (p-value)	Stance Times (p-value)	Swing Times	Positive Rate	Postoperative Outcome (p-value)	Preoperative HHS (p-value)	1-Year HHS (p-value)
Present Study (Posterior Approach)	Longer ($p<0.05$)	Higher ($p<0.05$)	Shorter ($p<0.05$)	Similar	Fewer	Improved ($p<0.05$)	Higher ($p<0.05$)	Higher ($p<0.05$)
Study 1 [13]	Improved	Similar	Longer	Similar	Higher	Improved ($p<0.05$)	Lower ($p<0.05$)	Higher ($p<0.05$)
Study 2[14]	Longer	Similar	Shorter	Similar	Higher	Improved ($p<0.05$)	Lower ($p<0.05$)	Higher ($p<0.05$)
Study 3 [15]	Comparable	Higher	Similar	Similar	Comparable	Comparable ($p>0.05$)	Comparable ($p>0.05$)	Comparable ($p>0.05$)

Gait Analysis

Comparing the present study to Study 1, which demonstrated enhanced stride lengths but comparable cadences, the gait analysis findings from the Posterior Approach revealed significantly longer stride lengths and higher cadences. In Study 1, stride lengths were reduced, but in Study 2 and 3, they were the same. In contrast to the longer stance durations observed in Study 1 and the shorter stance durations

observed in Study 2, the stance durations observed in your study were shorter. All investigations revealed nearly identical swing times.

Trendelenburg Test

Compared to Study 1, which reported a higher positive rate, the current study demonstrated a lower percentage of patients with positive Trendelenburg test results, which suggests improved hip muscle function. Comparable Trendelenburg test results were found in Studies 2 and 3. The postoperative outcomes were also superior in your study and Study 1 but identical in Studies 2 and 3.

Functional Outcomes (HHS)

In the current research, HHSs were greater both before and after surgery, in contrast to the lower HHSs found in study 1. In both investigations, preoperative scores were either lower or comparable to the present study at both time points.

Limitations of the Study

We employed a retrospective design with disadvantages such as possible selection bias and absent data. The study's applicability to the general population was restricted because it was conducted at a singular centre. One year after surgery, patients continued to be observed. The long-term impacts were not evaluated, so today's advantages might be gone tomorrow.

The surgeon's experience, the type of implant used, and the presence of concurrent illnesses were not considered.

Conclusion

By comparing the outcomes of lateral and posterior approaches for primary THA, we highlight the clinical significance of the choice of surgical approach with substantial evidence. Patients who underwent THA via the posterior method exhibited longer strides, faster cadences, and shortened stance durations. Patients who have lost the ability to walk normally and effectively may significantly benefit from these developments. The posterior technique consistently lowered Trendelenburg test positivity, indicating improved hip abductor muscle function. According to these findings, patients who fear losing hip muscle strength or stability while walking might profit from the posterior approach. The HHS, a measurement of hip function and health indicates that the posterior technique consistently produces superior functional outcomes. Based on these findings, it is evident that selecting the optimal surgical strategy is crucial for enhancing the quality of life of THA patients.

Clinical Implications

In THA, the surgeon's choice of surgical strategy significantly affects patient outcomes and emotions. Our findings provide physicians with new tools to offer the best potential care for their patients. While hip mobility, hip muscle function, and patients' health are of the utmost importance, surgeons may choose the posterior approach.

Future Research

Our work contributes to the body of knowledge, but many unanswered concerns remain. Long-term follow-up studies are required to ascertain whether or not the benefits observed with the posterior method are durable. Research on patient-reported outcomes, such as quality of life and pain ratings, may provide a more comprehensive understanding of the patient's experience. This paper highlights the surgical strategy for primary THA. Comparing gait outcomes, hip muscle function, and effective recovery, the posterior approach emerges as the clear victor. This study emphasises the need for individualised, evidence-based orthopaedics decision-making to improve health outcomes and quality of life. As the healthcare system evolves, our research seeks to inform clinical practice, enhance patient care, and stimulate additional research in this area of medicine.

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