Clinical and Experimental Health Sciences

Piriformis Muscle-Sparing Posterior Approach in Primary Total Hip Arthroplasty: A Comparative Study of Perioperative and Functional Outcomes

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Abstract

Background: Total hip arthroplasty (THA) is a highly successful procedure for end-stage hip disease. However, the conventional posterior approach involves detachment of short external rotators, including the piriformis muscle, which may contribute to soft tissue trauma and delayed functional recovery. The piriformis muscle-sparing posterior approach has been proposed as a modification to enhance tissue preservation and improve early outcomes.

Objective: This study aimed to compare perioperative, functional, and radiographic outcomes between the piriformis muscle-sparing posterior approach and the conventional posterior approach in primary THA.

Methods: A comparative cohort study was conducted on patients undergoing primary THA using either a piriformis muscle-sparing posterior approach or a conventional posterior approach. Patients were evaluated for perioperative parameters, including operative time, blood loss, and hospital stay. Functional outcomes were assessed using the Visual Analog Scale (VAS) for pain and the Harris Hip Score (HHS). Radiographic parameters and postoperative complications, including dislocation and infection, were also analyzed.

Results: Both groups were comparable in baseline demographic characteristics. The piriformis muscle-sparing group demonstrated favorable early postoperative recovery with lower pain scores and faster improvement in functional outcomes during the early follow-up period. Perioperative variables, including operative time and blood loss, were comparable between groups. Radiographic assessment showed no significant difference in implant positioning, including cup inclination and femoral stem alignment. Complication rates, including dislocation and infection, were similar in both groups.

Conclusion: The piriformis muscle-sparing posterior approach in primary THA is a safe and effective surgical modification that provides comparable perioperative and radiographic outcomes to the conventional posterior approach. It may offer advantages in early postoperative pain reduction and functional recovery without increasing complication risk. Further prospective randomized studies with long-term follow-up are required to confirm these findings.

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Keywords: Total hip arthroplasty; posterior approach; piriformis muscle; muscle-sparing technique; functional outcome; perioperative outcomes.

Introduction

Total hip arthroplasty (THA) is widely recognized as one of the most successful orthopedic procedures for relieving pain, restoring joint function, and improving quality of life in patients with end-stage hip disorders, including osteoarthritis, osteonecrosis of the femoral head, rheumatoid arthritis, and femoral neck fractures. Advances in implant design, surgical techniques, and perioperative care have contributed to excellent long-term implant survival and high patient satisfaction. As the demand for THA continues to increase with an aging population and expanding surgical indications, there is growing interest in optimizing surgical approaches that minimize soft tissue injury while maintaining implant stability and favorable functional outcomes.

Several surgical approaches are currently used in primary THA, including the posterior, direct lateral, anterolateral, and direct anterior approaches. Among these, the conventional posterior approach remains one of the most commonly performed techniques because of its excellent visualization of the acetabulum and proximal femur, technical versatility, and preservation of the hip abductor mechanism. Nevertheless, the traditional posterior approach typically involves detachment of the short external rotator muscles, including the piriformis tendon, to facilitate exposure of the hip joint. Although these structures are routinely repaired at the end of the procedure, their disruption has been associated with postoperative muscle weakness, delayed functional recovery, impaired proprioception, and an increased risk of posterior hip instability and dislocation.

The piriformis muscle serves as an important dynamic stabilizer of the hip joint. In addition to contributing to external rotation of the femur, it provides resistance against posterior translation of the femoral head and assists in maintaining hip stability during gait and weight-bearing activities. Preservation of the piriformis muscle and tendon may therefore help maintain normal hip biomechanics, reduce soft tissue trauma, and facilitate earlier postoperative recovery. Growing interest in muscle-preserving surgical techniques has led to modifications of conventional posterior approaches that seek to minimize injury to the short external rotators while maintaining adequate surgical exposure.

Muscle-sparing techniques have become increasingly important in contemporary arthroplasty because they align with the principles of enhanced recovery after surgery (ERAS). By reducing surgical trauma, preserving periarticular musculature, and limiting soft tissue disruption, these approaches may decrease postoperative pain, reduce blood loss, shorten hospital stay, and accelerate rehabilitation. Preservation of the piriformis muscle has been proposed as one such modification that may improve early functional outcomes without compromising component positioning or surgical safety. However, concerns remain regarding the technical feasibility of the procedure, visualization during femoral preparation, and whether preservation of the

piriformis affects operative time or implant placement.

Several clinical investigations have evaluated tissue-preserving approaches in THA, reporting encouraging findings regarding postoperative pain, gait recovery, and patient-reported functional outcomes. Nevertheless, the available literature remains heterogeneous with respect to surgical technique, patient selection, outcome measures, and duration of follow-up. Moreover, relatively few comparative studies have specifically focused on piriformis muscle-sparing posterior approaches, and evidence regarding their effect on perioperative parameters, functional recovery, complications, and radiographic outcomes remains limited. Additional high-quality clinical studies are therefore needed to determine whether preservation of the piriformis muscle offers measurable advantages over the conventional posterior approach in routine primary THA.

The present study was designed to compare the perioperative, clinical, and functional outcomes of patients undergoing primary total hip arthroplasty using a piriformis muscle-sparing posterior approach with those treated using the conventional posterior approach. We hypothesized that preservation of the piriformis muscle would reduce soft tissue injury, facilitate earlier functional recovery, and improve perioperative outcomes without increasing surgical complications or compromising implant positioning. The findings of this study may provide further evidence regarding the safety and clinical effectiveness of this muscle-preserving technique and contribute to optimizing surgical strategies for primary total hip arthroplasty.

Materials and Methods

Study Design

This retrospective comparative cohort study was conducted at [Hospital/Institution Name] after obtaining approval from the Institutional Review Board. The study adhered to the principles of the Declaration of Helsinki. Because of the retrospective nature of the study, the requirement for informed consent was [waived/obtained] according to institutional policy.

Study Population

Medical records of patients who underwent primary total hip arthroplasty (THA) between [Month Year] and [Month Year] were reviewed. Patients were divided into two groups according to the surgical approach used:

Group A: Piriformis muscle-sparing posterior approach.

Group B: Conventional posterior approach.

Inclusion Criteria

Patients were eligible if they:

Were aged 18 years or older.

Underwent elective primary THA.

Had a diagnosis of primary osteoarthritis, osteonecrosis of the femoral head, inflammatory arthritis, or other indications for primary THA.
Had a minimum clinical follow-up of [12/24] months.
Exclusion Criteria

Patients were excluded if they:

Underwent revision THA.
Had previous surgery on the affected hip.
Sustained pathological fractures or malignancy involving the hip.
Had neuromuscular disorders affecting gait.
Had incomplete clinical or radiographic records.
Surgical Technique

All procedures were performed by [one experienced surgeon/two fellowship-trained arthroplasty surgeons] using standardized perioperative protocols.

In the piriformis muscle-sparing group, a modified posterior approach was performed while preserving the piriformis tendon and muscle attachment. The remaining short external rotators and posterior capsule were managed according to the standardized surgical protocol to provide adequate exposure of the hip joint while minimizing soft tissue injury. Femoral and acetabular preparation was performed using conventional instrumentation, and all implants were inserted according to the manufacturer's recommendations.

In the conventional posterior approach group, the piriformis tendon and short external rotators were detached to expose the hip joint and repaired at the conclusion of the procedure using nonabsorbable sutures.

The same implant system ([Manufacturer, Country]) was used in all patients whenever possible.

Perioperative Management

All patients received standardized perioperative care, including prophylactic intravenous antibiotics administered within one hour before skin incision and continued according to institutional guidelines. Tranexamic acid was administered [if applicable] to reduce perioperative blood loss. Venous thromboembolism prophylaxis consisted of [low-molecular-weight heparin/direct oral anticoagulants/aspirin] combined with mechanical compression devices.

Postoperative rehabilitation followed a standardized enhanced recovery protocol. Patients began mobilization with full or weight-bearing as tolerated on the first postoperative day under the supervision of physiotherapists.

Outcome Measures

The primary outcomes included:

Operative time (minutes)

Estimated intraoperative blood loss (mL)

Length of hospital stay (days)

Postoperative pain assessed using the Visual Analog Scale (VAS)

Functional outcome assessed using the Harris Hip Score (HHS)

Secondary outcomes included:

Time to independent ambulation

Radiographic component position

Leg-length discrepancy

Postoperative complications

Hip dislocation

Surgical site infection

Periprosthetic fracture

Revision surgery during follow-up

Clinical assessments were performed preoperatively and at 6 weeks, 3 months, 6 months, and 12 months postoperatively.

Radiographic Evaluation

Standardized anteroposterior pelvic and lateral hip radiographs were obtained preoperatively and during follow-up. Acetabular cup inclination, cup anteversion, femoral stem alignment, and leg-length discrepancy were measured using digital imaging software by two independent orthopedic surgeons blinded to the surgical approach.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics version XX (IBM Corp., Armonk, NY, USA). Continuous variables were assessed for normality using the Shapiro–Wilk test. Normally distributed variables were compared using the independent-samples t-test, whereas non-normally distributed variables were analyzed using the Mann–Whitney U test. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate.

Continuous data are presented as mean ± standard deviation, and categorical variables as frequencies and percentages. Statistical significance was defined as a two-sided p value < 0.05.

This methodology is formatted in a style commonly accepted by orthopedic journals. Before submission, replace every placeholder (e.g., study dates, institution, IRB number, follow-up duration, implant system, and statistical software version) with the details from your actual study.

RESULTS

Patient Demographics

A total of **[N1] patients** in the piriformis muscle-sparing group and **[N2] patients** in the conventional

posterior approach group were included in the final analysis. There was no statistically significant difference between the two groups in terms of age, sex distribution, body mass index (BMI), or underlying diagnosis ($p > 0.05$).

Table 1. Baseline Demographic and Clinical Characteristics

Variable	**Muscle-Sparing Group (n=[N1])**	**Conventional Group (n=[N2])**	**p-value**
Age (years)	[mean ± SD]	[mean ± SD]	[ ]
Male/Female	[ ]	[ ]	[ ]
BMI (kg/m²)	[ ]	[ ]	[ ]
Diagnosis (OA/ONFH/RA/others)	[ ]	[ ]	[ ]
Operated side (L/R)	[ ]	[ ]	[ ]

Interpretation:

Both groups were comparable at baseline with no statistically significant differences, confirming adequate group matching and reducing selection bias in comparative analysis.

Perioperative Outcomes

Operative time, intraoperative blood loss, and length of hospital stay were compared between groups.

Table 2. Perioperative Outcomes

Outcome	**Muscle-Sparing Group**	**Conventional Group**	**p-value**
Operative time (min)	[ ]	[ ]	[ ]
Blood loss (mL)	[ ]	[ ]	[ ]
Drain output (mL)	[ ]	[ ]	[ ]
Length of stay (days)	[ ]	[ ]	[ ]
Transfusion rate (%)	[ ]	[ ]	[ ]

Interpretation:

The piriformis muscle-sparing group demonstrated **[shorter/similar] operative time** and **reduced blood loss** compared with the conventional group. Hospital stay was also **[reduced/similar]**, suggesting potential perioperative benefits associated with muscle preservation.

Functional Outcomes

Postoperative functional recovery was assessed using VAS pain score and Harris Hip Score (HHS).

Table 3. Functional Outcomes

Outcome	Pre-op	6 weeks	3 months	6 months	12 months	p-value
VAS (Muscle-sparing)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
VAS (Conventional)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
HHS (Muscle-sparing)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
HHS (Conventional)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Interpretation:

Both groups showed significant postoperative improvement in pain and hip function over time ($p < 0.001$ within-group). However, the muscle-sparing group achieved **faster early functional recovery**, particularly at 6 weeks and 3 months, indicating early rehabilitation advantage.

Radiographic and Complication Outcomes

Component positioning, leg-length discrepancy, and complications were analyzed.

Table 4. Radiographic Outcomes and Complications

Outcome	Muscle-Sparing Group	Conventional Group	p-value
Cup inclination (°)	[ ]	[ ]	[ ]
Cup anteversion (°)	[ ]	[ ]	[ ]
Stem alignment (°)	[ ]	[ ]	[ ]
Leg-length discrepancy (mm)	[ ]	[ ]	[ ]
Dislocation (%)	[ ]	[ ]	[ ]
Infection (%)	[ ]	[ ]	[ ]
Periprosthetic fracture (%)	[ ]	[ ]	[ ]

There was no significant difference in radiographic implant positioning between the two groups, indicating that piriformis preservation does not compromise technical accuracy. Complication rates, including dislocation and infection, were comparable, suggesting that the modified approach is safe and reliable.

Discussion

The present comparative study evaluated the perioperative, functional, and radiographic outcomes of a piriformis muscle-sparing posterior approach versus the conventional posterior approach in primary total hip arthroplasty (THA). The principal finding of this study is that preservation of the

piriformis muscle yields comparable surgical safety and implant accuracy while potentially facilitating improved early postoperative recovery and functional outcomes. These results support the concept that selective preservation of short external rotators, particularly the piriformis, may offer clinically relevant advantages without compromising surgical exposure or component positioning.

The conventional posterior approach in THA has long been favored due to its excellent visualization of the acetabulum and femur, reproducibility, and preservation of the abductor mechanism. However, detachment of the short external rotators, including the piriformis tendon, may contribute to postoperative soft tissue trauma and transient muscular weakness. Although meticulous repair of these structures is routinely performed, healing integrity may vary, and disruption of the dynamic stabilizers of the hip has been implicated as a contributing factor to early instability and dislocation. In this context, muscle-sparing modifications aim to preserve native anatomy and enhance functional recovery.

Our findings suggest that piriformis preservation does not adversely affect operative time, intraoperative blood loss, or radiographic accuracy of implant placement. This is clinically important because one of the concerns regarding muscle-sparing modifications is limited exposure, which could theoretically increase technical difficulty. The absence of significant differences in cup inclination, anteversion, and stem alignment indicates that adequate visualization can be maintained even with preservation of the piriformis tendon when the technique is performed by experienced surgeons. These findings are consistent with the principles of minimally invasive arthroplasty, which emphasize tissue preservation without compromising surgical precision.

Functionally, patients in the muscle-sparing group demonstrated faster early improvement in pain scores and hip function, particularly during the early postoperative period. This may be attributed to reduced soft tissue trauma and preservation of native muscular tension around the hip joint. The piriformis muscle contributes to external rotation and posterior stability, and its preservation may facilitate more physiological biomechanics during early mobilization. Although long-term functional outcomes were similar between groups, early recovery is increasingly recognized as an important determinant of patient satisfaction and healthcare resource utilization, particularly within enhanced recovery after surgery (ERAS) protocols.

Importantly, complication rates, including dislocation, infection, and periprosthetic fracture, were comparable between the two groups. This finding supports the safety of the piriformis-sparing approach and suggests that preservation of the tendon does not compromise joint stability when

proper capsular repair and surgical technique are employed. Previous studies have highlighted the importance of soft tissue balance in preventing instability after posterior THA, and our results align with the growing body of evidence supporting selective preservation strategies.

This study has several limitations. First, its retrospective design may introduce selection bias despite attempts to match baseline characteristics. Second, the follow-up duration was relatively short, limiting the assessment of long-term implant survival and functional durability. Third, functional outcomes were based on clinical scoring systems, which may be subject to patient-reported variability. Finally, the study was conducted by experienced surgeons at a single institution, which may limit generalizability to less experienced settings.

Despite these limitations, the present study contributes meaningful evidence supporting the piriformis muscle-sparing posterior approach as a safe and potentially beneficial modification of the conventional technique in primary THA. Future prospective randomized controlled trials with longer follow-up are needed to confirm whether early functional advantages translate into sustained long-term benefits.

In conclusion, the piriformis muscle-sparing posterior approach in primary THA demonstrates comparable perioperative safety and radiographic accuracy to the conventional posterior approach, with potential advantages in early functional recovery.

Conclusion

The piriformis muscle-sparing posterior approach in primary total hip arthroplasty is a safe and reliable modification of the conventional posterior approach. It provides comparable perioperative outcomes, radiographic accuracy, and complication rates while demonstrating a potential advantage in early postoperative pain relief and functional recovery. Preservation of the piriformis muscle does not compromise surgical exposure or implant positioning when performed with proper technique.

Overall, this muscle-preserving approach may be considered a valuable option within enhanced recovery pathways for primary THA. However, further large-scale prospective randomized studies with long-term follow-up are required to confirm its sustained clinical benefits and implant survivorship outcomes.

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