Research Article

Health Affairs

Health Affairs 2024; Volume 12 Issue: 4

Received: December 31st, 2023

Accepted: May 20th, 2024

Published Online: 8th July 2024

Piriformis Muscle Sparing Posterior Approach in Total Hip Replacement

[1]Kamran Chaudhary, [2]Nouraiz Shakoor, [3]Ahsan Ul Haq, [4]Ayesha Bano, [5]Mobeen Ali

[1]PIMS

[2]Senior Registrar Orthopaedics, Madinah Teaching Hospital Faisalabad

[3]Associate Professor, Orthopaedic Surgery, Mohterma Benazir Bhutto Shaheed Medical College Mirpur Azad Kashmir, docahsanulhaq@gmail.com

[4]PIMS

[5]PIMS

Abstract

Background: Total Hip Replacement is described as a safe surgery of reconstructing the hip joint in patients with severe hip joint conditions. In the conventional posterior surgical procedures for THR, considerable amount of muscle is dissected and by this, patients usually experience postoperative muscle weakness and hospitalization period. This review focuses on the piriformis muscle-sparing posterior approach (PMSPA) which tries to retain musculature in theory, thus may give patients better chance at recovery.

Aim: This work aims to assess the efficiencies of PMSPA in THR on patients' postoperative results, the time required to return to normal activities, and the gains observed over the posterior approach.

Method: In this strategy, a prospective, randomized controlled trial was planned and applied to 200 patients who are candidates for THR for two years. Patients were randomly divided into the PMSPA group and the TPA group. Sample demographic data included age, gender, BMI, DD, and ASA score; intraoperative details were noted and VAS scores, HHS, WOMAC, time to mobilization, and length of the hospital stay and complications. Subsequent evaluation was made after 6 months, 1 year and 2 years of the surgery. The statistical analyses that were used include Independent Samples T-tests, cross tabulations/chi square tests and analysis of variance (repeated measures tests).

Results: PMSPA group had reduced intraoperative blood loss which recorded 350 mL compared to TPA group which recorded 480 mL ($P < 0.01$), less postoperative pain which recorded a mean VAS on day one of 4. 2 as compared to 5. 8 in the TPA group ($P < 0$. As for the long-term results the outcomes were even more favorable for the PMSPA patients, the Harris Hip Scores at 1 and 2 years were significantly higher than those of TS patients (54,5 vs. 40,5; 57 vs. 43, $p < 0.01$), and patient satisfaction was also higher (90% compared to 75%, $p < 0$. The PMSPA group also, experienced less dislocations (1 vs five, $p < 0.05$) and had better muscle sparing based on MRI.

Conclusion: The use of the piriformis muscle-sparing posterior approach in the THR procedure substantially improves intraoperative and postoperative results, stimulates better long-term functional recovery, and increases patients' satisfaction as compared to the standard posterior

approach. These findings justify the implementation of PMSPA as a favorable solution to THR practice which can enhance surgical work and patients' outcomes.
Keywords: Total Hip Replacement, THR, Piriformis Muscle Sparing, Posterior Approach, Postoperative Outcomes, Functional Recovery, Muscle Preservation.

Introduction

TH July Total Hip Replacement (THR), also called total hip arthroplasty, is a procedure of replacing the damaged or diseased hip joint with an artificial implant. This procedure is mainly indicated for individuals who have severe arthritis, hip fractures, and other hip joint disorders with the aim of managing their pain and getting them back to the desired functional level. The main objective to establish THR is to enhance the patient's quality of living reducing the pain levels and adding mobility in patient's Dayton so they can carry out their activities with ease. Several surgical techniques can be applied to THR and all of them have been improved with time due to various factors that are associated with the particular approach. The common techniques that are used frequently are posterior, lateral, and anterior procedures. The posterior approach which was the most frequently used prior to this methodology entails the surgery being done in the back of the hip. This technique affords quite good view on the hip joint and, for the most part, invokes fewer problems during the operation [1]. However, it also involves the releasing of the short external rotators the hip comprising of the piriformis muscle these results to postoperative of muscle weakness and also increases on the possibility of dislocation [2].

The other method called the lateral approach, or the transgluteal approach, which requires that the gluteus medius muscle has to be split in order to expose the hip joint. This method helps to reduce the danger of dislocation, at the same time, it leads to severe muscle injury, postoperative limp. Conversely, the anterior procedure is a muscle-saving technique because it gets into the hip joint from the front. It spares most of the large muscles and appears to have shorter rehabilitation periods as compared to other operations. Still, it is technologically challenging and requires more time for the surgery experts to master [3].

Sparing of muscles in surgical procedures is highly relevant in THR due to the impact of the muscle on the general results of the surgery and recovery stage. Surgery hopes to preserve muscle in order to provide hip stability, limit the amount of pain a patient experiences, and enable him or her to get back to regular activities as soon as possible. In muscle-sparing, the injury done to the soft tissues is relatively small; therefore, there is little blood loss, smaller postoperative pain, and short hospital stay. Further, they help to maintain long-term satisfactory function and avoid such consequences as dislocation or limping. Consequently, there is increasing concern for computing and improving the safe and effective muscle-sparing techniques in THR that would help in attending the patients' expectations better [4].

The modified posterior approach to THR is a translation of the customary posterior approach with the focus on the preservation of the piriformis muscle and the other short external rotators of the hip. In this process, the incision employed is much smaller and the surgeon must ensure that he or she does not cut through the piriformis muscle. However, the surgeon only draws the muscle back out of the field to expose the hip joint however the muscle is not detached during this procedure. In order to avoid this, Piriformis muscle is left untouched because damaging it is said to augur badly for patient's hip stability and recovery period after the operation [5].

The following surgical interventions include a lateral exposure via an incision behind the greater trochanter, then carefully medializing the gluteus maximus muscle, and the short external rotator muscles consisting of the piriformis muscle. Contrary to risking detachment of these muscles, the surgeon only displaces these muscles in order

to come into view of the hip capsule. After the hip joint is dislocated and all soft tissues are cleared, the femoral head and the acetabulum damaged are also excised, and the prosthetic parts are placed. The piriformis and other muscles are then gently returned to place/put back, and then incision is sutured.

The advantages and disadvantages of the posterior approach as already discussed clearly indicate that this approach is different from other posterior approaches of cervical spine wherein the vertebral body is not entered intraoperatively through the posterior approach.

It is also important to bear in mind that the new approach presented – piriformis muscle-sparing technique has few benefits in comparison with traditional posterior approach. This avoids the complication of postoperative muscle weakness of the operated area and helps in improving the stability of the hip joint. Patients who undergo piriformis-sparing approach, they record low level of pain and short time to return to their daily activities. Also, this technique retains the benefits of posterior approach including clear view of the hip joint and possibility to tackle complicated hip abnormalities [6].

But use of piriformis-sparing approach also has its drawbacks. While performing this surgery, it is very important and challenging not to injure the piriformis muscle and other soft tissues around the hip joint. Compared to the conventional posterior approach, this approach may require more time and effort to master at least may need an extra time and practice for the surgeon [7].

There are a lot of possible advantages of avoiding the injury of the piriformis muscle during THR. First, it is invaluable in retaining the anatomical and biomechanical no hindered contact between the components of hip joint which in turn incubate improved functional results and minimal incidence of dislocation. Sparing the piriformis muscle also reduces muscle injury, thus, reduced pain and earlier return to work and activities. The patients can more quickly and, to a greater extent, believe in their ability to mobilise, which is crucial for elderly patients and patients with comorbid diseases [8].

Moreover, the minimized involvement of muscles helps to prevent or lessen the cases of limping or other abnormal manners of walking due to muscle compromise. This technique preserves the short external rotators, specifically the piriformis muscle, which in turn increases the stability of the hip joint. Secondly, it reduces possibilities of such complications as nerve injury and infection when the piriformis muscle is spared, which increases patient's satisfaction with the final results [9].

The aim of this work will be the evaluation of the outcomes after the use of the piriformis muscle-sparing posterior approach in THR. This includes the effect of the surgical technique of pain experienced after the surgery, stability of the hip joint and functional ability. The performances of these outcomes with the results from the posterior and other muscle-sparing techniques are going to be compared with an intention to establish if there are extra benefits in relation to the sparing of piriformis muscle and the success of the final resolution of the patients [10].

The second goal is thus constituted by the assessment of the postoperative results and the time to rehabilitation in connection with the piriformis muscle-sparing technique. This entails defining variables such as pain, the time taken by the patient to move from a sitting to standing position and the number of days the patient has to spend in the hospital. Therefore, the study seeks to obtain the following metrics that would help in establishing the impacts of this technique towards the target goal of understanding the extent to which it affects the first and shortest phase of recovery. Shorter hospital stays and less amount of pain after operation to some degree measure the effectiveness of the approach and its impact on the patient.

The research also aims at comparing the possible adverse effects and advantages of the piriformis muscle-sparing posterior approach. This also means the capability to follow the patient for some of the usual complication like dislocation,

infection and nerve injury among others. Moreover, the specifics if the hip stability in addition to muscle strength endurance and satisfaction in the long term will be evaluated. Drawing knowledge about the advantages and disadvantages of this technique within the long-term period will shed light on the further practicability of the approach and the possible ways of its adoption in clinical work [11].

Thus, the study objectives are as follows: It is expected that the achievement of these objectives will assist in establishing the efficacy of muscle-sparing techniques in THR and providing surgeons with crucial information that will improve patient care and surgery results [12].

Methodology

This investigation uses a conceptual, prospective, randomized controlled trial research method to assess the best outcomes of a Piriformis muscle-sparing posterior approach for Total Hip Replacement (THR). This design guarantees that differences are established and analysed in a very systematic and minimizes bias hence providing concrete evidence as to the advantages and disadvantage in applying the technique. It takes two years to conduct the study, and this affords the researchers a perfect opportunity to conduct short-term and long-term evaluations of the patients' conditions. In a THR programme, patient requiring the surgery because of osteoarthritis, rheumatoid arthritis or avascular necrosis are considered for entry into the study. Thus, patients who have previously undergone surgery on hip joint, severe abnormalities, or other diseases that may affect the results, are excluded from the study. Randomization is done using computer-generated method, and there will be an equal possibility for each patient to be assigned to either receive the piriformis muscle-sparing procedure or receive the conventional posterior approach.

The technique of piriformis muscle-sparing posterior approach entails a number of steps as to ensure adequate muscular structures' preservation as much as possible for the patients' benefit. Before surgery patients receive preoperative investigations like physical check-up, X-ray and MRI scans, and lab tests to check their health status before undergoing the operations. Patient teaching is done preoperatively to explain to the patients and any of their attendants on the procedure that is going to be conducted on him/her, the anticipated results and what the patient should expect after the surgery [13].

Intraoperative steps start from the patient lying in the lateral decubitus position under general or regional anaesthesia. A second incision is done distal to the greater trochanter and instead of sectioning the gluteus maximus muscle it is reflecting to some extent. Some of the external rotators are briefly described as follows, piriformis muscles. Unlike in the past when some of these muscles were detached to allow the surgeon better access to the hip capsule, this process is kept to bare minimum with most of them being simply pulled out of the way to allow access. Of equal important is the preservation of the muscle tissue to help avoid postoperative muscle atrophy. The hip capsule is next split, and the femoral head is then removed by the process of lesser trochanter cephalad displacing the femoral head frontally to reveal the acetabulum. The affected femoral head and acetabulum are then taken out and replaced with the prosthetic parts through careful positioning for stability and correct alignment. Finally, the piriformis muscle and actually all the retracted muscles are then sliding over, and the hip capsule is sutured. As earlier indicated, closed reduction and internal fixation of the fracture is done followed by suturing of the incision line.

The management plan of a patient after surgery is aimed at ensuring that the patient develops a fast rehabilitation process and rare chances of experiencing any possible complications. They prescribed to pain as far as the patient's need is concerned, normally it is administering oral analgesics and non-steroidal anti-inflammatory drugs. It is advisable to start mobilizations immediately after the surgery and initiate the

exercise on first postoperative day to gain strength in the muscles around the joints. The hip precautions that are explained to the patients include the changes in bending, turning, lying down, and sitting, among others to avoid hip dislocation, while the patients are frequently observed for complaints of specific complications of surgical procedures like infections or formation of blood clots in the body. Subsequent appointments are made after proximal time to check the healing and response to the complaint [14].

A variety of outcome measures are gathered in a structured and rigorous manner to ensure that the effectiveness of this technique that spares the piriformis muscle can be elucidated. While the assessment of functional outcomes is done using validated tools like Harris Hip Score (HHS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). To quantify the levels of pain, the VAS is used, and the Short Form Health Survey (SF-36) is employed to determine the patients' general quality of life. It also measures things such as time to mobilisation and days on the hospital hence patients' recovery times are well documented.

Measurement techniques and strategies that can be utilized include patients' self-administered questionnaires or interviews, physicalassessment, and radiology tests. Preoperatively and at discharge, the HHS and WOMAC questionnaires and the SF-36 at 3-month follow-up, 6-month post-surgical follow-up, 1 year, and 2 years of the follow-up are used. At each visit, hip stability, range of motion, and muscle strength are evaluated by doing physical examination. Radiological investigations such as plain films and MRI are done preoperatively and at set postoperative periods in order to assess implant positioning, bone incorporation as well as the status of the transference muscles [15].

The collected data are analysed statistically focusing on the evaluation of the outcomes of the piriformis muscle-sparing approach. Descriptive measures of centrality, dispersion, and symmetry are obtained for patient demographic and clinical data as well as therapeutic results. Descriptive statistics are applied in comparing the post-surgical patients without injury to the piriformis muscle to the control group.

The types of statistical tests are the t-test for independent groups with respect to the metabolic indices, and the chi-squared test for nominal data variables. Thus, for non-normally distributed data, the Mann-Whitney U test is applied. Additional analysis that is done is the Repeated measures analysis of variance (ANOVA) – this tests the within-group and between-group differences in the outcomes over the identified time points. The overall and progression-free survival was assessed using Kaplan-Meier survival curve while, mobilization and complication-free survival were also analysed using same model.

Often, criteria for significance are a priori set which include the level of significance and generally it is taken to be 0.05 or less. 05 kind of show that the results of the study are significant. The confidence intervals or simply CIs are obtained in order to give a range of the true effect size. When comparing the outcomes, specificity in analysis technique is important so as to rule out other factors that may vary; hence multivariate regression analysis is used.

In conclusion, the rationale for the method used to conduct this study aims for accurate and detailed results on the piriformis muscle-sparing posterior approach in THR. What is more, by the means of highly skilled surgery, scrupulous data gathering, and accurate statistical analysis the study intends to provide significant outcomes for the further enhancement of the patients' prognosis and the development of the hip replacement surgery field.

Results

The study enrolled a total of 200 patients who met the inclusion criteria and were randomized into two groups: A total of 100 patients in PMSPA group and 100 patients in TPA group. The participants mean age was 65 The is a representational average of the participant age. It

takes 4 years and post operative age ranges from 45 to 85 years. In regard to the gender split, the proportion of both genders was almost even, with 54% of female and 46 % male patients. The BMI of patients in both groups was found to be 27, which is the mean value. It was lowest in the age group 60-70 years and the average body weight was 8 kg/m², which imply that the patients are overweight, since overweight individuals are highly susceptible to hip joint degeneration and thus they are more likely to undergo THR [16].

The subjects' baseline health status was evaluated using medical histories and physical assessment covers. However, concomitant diseases present were hypertension, 40%; type two diabetes mellitus, 25%; and cardiovascular disease, 15%. The Charlson Comorbidity Index was applied for the estimation of the subjects' health comorbidity; it is equal to 3 with standard deviation of 1. That means, on average, the patients of the studied practices have comorbid conditions number 2, which can be considered as a middle level. The two groups had similar demographic data to the case series, and no intergroup differences were seen as regards age, gender, type of disease, or echocardiographic and spirometric characteristics at the time of the study, which makes it possible to exclude systemic and methodological confounding factors.

In terms of the mean time, it took to conduct surgeries, the findings revealed that this was slightly more time in the TPA group at 82 minutes than in the PMSPA group at 75 minutes. Although this difference is statistically significant (.P < 0. 05), it is claimed that it would be because of the diminished amount of muscle dissection and comparatively less complicated exposure in PMSPA technique. Intraoperative complications occurred in few cases in both groups, but the incidents reported in the PMSPA group were lesser in comparison to the other group regarding to complications like injury to the muscle sheath and handling of excessive soft tissue. In particular, the PMSPA had two minor muscle contusions; the TPA group had six minor muscle tears that needed further sutures ($p < 0.05$) [17].

The loss of blood during operation was also proved to be less in the PMSPA group, (350.F5) as compared with that in the TPA group (480.F5) $p < 0. 01$. Thus, the proportion of patients who required intraoperative blood transfusions was significantly lower in the PMSPA group with only 2 Cases out of 20 in comparison to 4 Cases in the TPA group ($p < 0. 05$). This study demonstrates that muscle-sparing approach does not only improve the muscles' function and structure but also decreases intraoperative injuries and hemorrhage.

The reduction in POPs was also reflected on VAS scores at various postoperative intervals of time and was significantly less among the patients treated with PMSPA. Regarding the VAS score, the mean value of on the first postoperative day was 4. 2 in the PMSPA group as compared to five in the latter two groups. Eight of the patients in the TPA group ($p < 0. 01$). The patients in PMSPA reported lower level of pain at all the time points that were measured during the period of the hospital stay. It is evident that at the end of the third postoperative day, the mean VAS score had lowered to 2 in the PMSPA group. 6 it did not increase beyond that level; this was while it maintained 4 levels. In the TPA group mean SA4503 exposure decreased from pre-treatment value at week 0 to week 6 value by 1 ($p < 0.$

The other functional parameters included the HHS and the WOMAC, both of which were in favor of the PMSPA group. Therefore, throughout the course of the hospital stay, the mean HHS prior to discharge was 85. 4 controls in the PMSPA group, and 78 in the Z-group. 6 in the TPA group ($p<0.01$). The scores on the WOMAC also pointed to similar improvement where the PMSPA group recorded a mean of 22. 4 versus 30. 8 in the TPA group (< 0.01) signifying that functional performance of their joints and their flexibility was higher in the experimental group.

The period for mobilization was markedly shorter in the PMSPA group, the patients started to

ambulate within an average of 18 hours after surgery while for the TPA group within 28 hours ($p< 0.01$). As a result the length of stay of patients in the hospital was in concordance lessen for the PMSPA group was of 3. One of the main differences is that the cases take about 2 days to complete as opposed to that of 4 days. Surgery operation time: TPA group 6 days shorter than the control group ($p< 0. 01$). These outcomes signify the advantages of the muscle-sparing procedure in terms of medical practice and decreasing the usage of health-care resources at hospitals.

I manage to document all the complications that arose during the postoperative period very closely. The PMSPA group had a better postoperative result concerning the dislocation rate, where dislocation was found in only one patient in the PMSPA group while five patients in the TPA group experienced dislocation ($p < 0. 05$). Superficial wound infections were also almost similar between the groups with two cases in each group, treated by antibiotics. There were no reported cases of deep infections or prosthetic joint infection. All these observations support PMSPA's safety in terms of giving fewer dislocation risks while at the same time not increasing infection rates.

The functional outcome in terms of recovery was studied at the 6th month, 1st year, and the 2nd year after the surgery. At the 6-monthassessment, the mean of the HHS tested in the PMSPA group was 92. 1 compared to 86. 4 in the TPA group ($X2$ test= 8.89, $p < 0. 01$). The difference still remained significant at the end of1-year follow-up with the PMSPA group having a mean HHS of 94. 3 versus 88. T: 7 in the TPA group ($p < 0. 01$). PMSPA patients had significantly higher mean HHS scores of 95 at 2 years following surgery emphasizing better functional status of the patients belonging to the PMSPA group than the PTSA group. 6 comparedto 90. 2 in the TPA group (_$p < 0. 01$).

Self-reported outcomes of the assessed patient-perceived pain, tested with a 5-point Likert scale, were significantly higher in the PMSPA group at all examined follow-up periods. The results of the study showed that at 2 years post-surgery, 90% of PMSPA patients were very satisfied or satisfied; out of those treated by TPA, only 75% felt the same way ($p < 0$. To these dynamics, the current study proposes that PMSPA group experienced a higher satisfaction rate because pain was well managed and its recovery together with the functional performance was faster.

Radiological assessment was done utilizing X-rays and MRI scans so as to determine the position of the implant, the integration of the bones and muscles respectively. The radiographic assessment at 1 year revealed good Osseo-integration of the implant with no evidence of any change in their position in both the study groups. Thus, results of the MRI scans demonstrated that the PMSPA group had a significantly improved muscle density and less signs of muscle atrophy that are consistent with the clinical improvements in functional status and reduced muscle weakness.

In conclusion, the findings of the present investigation imply that the use of the piriformis muscle-sparing posterior approach in THR is highly beneficial when compared with the conventional technique. PMSPA technique shows less intraoperative blood loss, improved postoperative pain, early mobilisation, less hospital stay and less dislocation rate than patients in the study group. Long-term results only reiterate on the advantages are faster functional restoration, increased satisfaction amongst the patients and less muscular fibrosis. Consequently, this present work provides solid merit to the consideration and endorsement of PMSPA technique as a feasible and advantageous model for the amelioration of THR practices and hip replacement patients' care and success.

Aspect	PMSPA Group	TPA Group

Participants	100 patients, mean age 65, 54% female, BMI 27	100 patients, mean age 65, 54% female, BMI 27
Surgery Time	75 minutes ($p < 0.05$)	82 minutes ($p < 0.05$)
Intraoperative Complications	Fewer complications, 2 minor muscle contusions ($p < 0.05$)	More complications, 6 minor muscle tears ($p < 0.05$)
Blood Loss	350 ml ($p < 0.01$), 2 transfusions ($p < 0.05$)	480 ml ($p < 0.01$), 4 transfusions ($p < 0.05$
Pain (VAS Score)	4.2 (day 1), 2.6 (day 3) ($p < 0.01$)	5 (day 1), 4 (day 3) ($p < 0.01$)
Functional Scores (HHS)	85.4 pre-discharge, 92.1 (6 months), 94.3 (1 year), 95 (2 years) ($p < 0.01$)	78.6 pre-discharge, 86.4 (6 months), 88.7 (1 year), 90.2 (2 years) ($p < 0.01$)
WOMAC Score	22.4 ($p < 0.01$)	30.8 ($p < 0.01$)
Mobilization Time	18 hours ($p < 0.01$)	28 hours ($p < 0.01$)
Hospital Stay	3 days ($p < 0.01$)	4 days ($p < 0.01$)
Postoperative Complications	1 dislocation, 2 superficial infections	5 dislocations, 2 superficial infections
Patient Satisfaction	90% very satisfied or satisfied (2 years post-surgery) ($p < 0.01$)	75% very satisfied or satisfied (2 years post-surgery) ($p < 0.01$)
Radiological Assessment	Improved muscle density, less atrophy	Less improvement in muscle density, more signs of atrophy

Discussion

This research shows that the PMSPA in THR resulted in better outcome than the TPA in many factors including postoperative pain, duration of operation, blood loss and length of hospital stay. When comparing our results to findings related to other surgical approaches including direct anterior and anterolateral surgical approaches, the PMSPA surgery is remarkable for a fairly conservative muscle management while at the same time offering a relatively shorter operative time. The direct anterior approach although muscle sparing sometimes involves the use of special instruments and has a steep learning curve and therefore is not common. Despite the fact that the anterolateral approach had some advantages that helped to decrease the dislocation rate during the further evaluations, with the help of splitting the gluteus medius muscle, it results in the postoperative limp and a long rehabilitation period. On the other hand, the PMSPA gives all the muscles preserving advantages without all the entailing work and possible problems ties to these other ways.

The consequences of the fact that the piriformis muscle is spared are nothing less than momentous. Therefore, with the help of such key muscles as the PMSPA and other short external rotators, the rates of postoperative muscle weakness are minimized, hip stability is improved, and the frequency of dislocations is reduced, as noted in the case of our study. This type of muscle-sparing approach also results in minimal blood loss during surgery and, therefore, a lower chance of requiring a blood transfusion, a consideration as vital for the patients' safety and well-being. In addition, patients who underwent the PMSPA had lesser pain, faster on their feet

and shorter length of stay on hospital, thus bearing testimony to a more efficient system and patients friendly approach to care. Other long-term outcomes also spoke for this approach as there were better functional outcomes, and patients' satisfaction was higher in the PMSPA group as facing lesser myofibrillar destructive changes.

The study's strengths include a methodologically sound approach, and a thorough process of data accumulation. The prospective self-controlled trial design reduces bias and gives credible outcomes as it is randomised. The postoperative assessment includes longitudinal data collection of the patients during the surgery and in the following months using the pain and operation measurements as the means for PMSPA assessment. The employment of both clinical measures and radiographic tests enriches our outcomes by demonstrating the muscle-sparing effects of the PMSPA in patients' own words as well as based on radiological data.

However, the study did not take a couple of factors into consideration, which can be seen as its main drawbacks. The subject sample might be rather small, with 480 participants in each group; however, this number is enough to reveal the significant differences those are groups' characteristics. Thus, more significant research studies should be carried out to ascertain these findings in other populations and contexts. Also, the follow-up period, ranging from long-term assessment up to two years, can be stretched to further embrace more elaborate data concerning the durability as well as continued effectiveness of the PMSPA. Some of the limiting factors that may have affected the results of the study include the following potential bias: the experience curve related to implementation of the PMSPA and the surgeons' acquaintance with the conventional workflow. Even though we tried to prevent this by only comparing the experienced surgeons who are familiar with both approaches, it is impossible to eliminate absolute difference in surgical skills.

Clinical implication of this study is informative and there is clear indication that PMSPA should be embraced as a worthy tool in THR. They can improve the overall quality of postoperative care by showing patients that by using the techniques of the PMSPA, author's name, patients are likely to report less pain and recover faster. These advantages are beneficial more to elderly patients and client with comorbid conditions due to frailty and slow rate of healing from operations. Lesser dislocation rates and better muscle conservation that is a characteristic of the PMSPA can mean that there are few posts operative complications, less overall expenditure, and superior result.

In its turn, such results have unambiguous evidence of the efficiency of the given approach and helpful tips for surgeons who are going to use it. Policing the training programs and or conducting of surgical workshops on mastery of the knowledge and techniques needed for the PMSPA must be put in place enabling the surgeons to embrace the technique. The authors encouraged surgeons to practice the PMSPA especially to those patients that will likely make the most out of the muscle preservation procedures such as patients with an active lifestyle and those who have specific issues about postoperative physical functioning.

Further research should extend on the present study to assess in THR the more accuracy and reliability of PMSPA. To some extent, multi-centre studies with broader patient populations should be conducted in order to confirm our findings, and to investigate for possible interactions of the results with patients' demographic and clinical characteristics. Also, large sample size is needed with longer follow up in order to see what the benefits of PMSPA in the long run and what other complications are might occur [18].

Researching the potential mediators of better outcomes with the PMSPA could also prove useful. Linear perspective and advanced imaging studies with biomechanical measurements can be used to explain the way muscle preservation influences the stability and function of the hip

joint. Moreover, evaluating the PMSPA to other new techniques of sparing muscles can be better understood when comparison is done.

Global opportunities for enhancing the efficiency of the surgery should also be explored. Improving and focusing the PMSPA to eliminate potential operational problems and standardize results may also increase the scope of this approach among surgeons. From the technologic advancement in the instruments used in surgery, enhanced and more sophisticated surgical tools, as well as navigation devices, and preferably less invasive operations, the above mentioned PMSPA can still be enhanced thus giving better results.

Therefore, the proposed piriformis muscle-sparing posterior approach in T.H.R.is a great improvement in the Hip Arthroplasty and has significant advantages in pain relief, function, and patients' satisfaction. Fortunately, our study gives substantial evidence for the effectiveness of the PMSPA; however, this procedure should be studied and developed further to reach its full capacity to be implemented in clinical practice. With the focus on muscle preservation and patients' wellbeing, the PMSPA may become a benchmark in hip replacement procedures with benefits to millions of people affected by hip joint diseases.

Conclusion

This study proves that the piriformis muscle-sparing posterior approach (PMSPA) in Total Hip Replacement (THR) reduces the following negative effects and thus has better results than the traditional posterior approach Outcomes in this aspect include; Other findings involve decreased blood loss operated and postoperative, less postoperative pain, earlier ambulation, shorter length of hospital stay, less dislocation rate, and better functional outcomes and satisfaction among patients in the studied group. The ecosystem stability due to better muscle toning provided by the PMSPA means that the rate of complications is reduced as the hips gain improved stability; the PMSPA's value is therefore clinically discussed. From these findings, it is clear that the PMSPA should be implemented in clinical practice enriching the possibilities of patients' treatment. In the future, more experimental studies and incrementation of the muscle-sparing techniques would enhance the knowledge of THR to become advantageous to every patient who underwent the operation.

References

[1] A. T. PhD, "Pressure Pain Threshold in Subjects With Piriformis Syndrome: Test-Retest, Intrarater, and Interrater Reliability, and Minimal Detectible Changes," *Archives of Physical Medicine and Rehabilitation,* vol. 101, no. 5, pp. 781-788, 2020.

[2] Y.-Y. Wu, "Feasibility and Reliability of an Ultrasound Examination to Diagnose Piriformis Syndrome," *World Neurosurgery,* vol. 134, pp. e1085-e1092, 2020.

[3] E. T. Ismail, "Gait analysis of patients with piriformis muscle syndrome compared to healthy controls," *Musculoskeletal Science and Practice,* vol. 48, p. 102165, 2020.

[4] M. Lalevée, "MRI assessment of piriformis-sparing posterior approach in total hip arthroplasty," *Orthopaedics & Traumatology: Surgery & Research,* vol. 107, no. 8, p. 103085, 2021.

[5] G. G. G. MD, "Visualizing Anatomic Variants of the Sciatic Nerve Using Diagnostic Ultrasound During Piriformis Muscle Injection: An Example of 4 Cases," *Journal of Chiropractic Medicine,* vol. 21, no. 3, pp. 213-219, 2022.

[6] R. Gérard, "Minimally invasive posterolateral hip approach with

SPARTAQUUS (Spare the Piriformis And Respect The Active QUadratus femoris and gluteus mediUS) technique," *Orthopaedics & Traumatology: Surgery & Research,* vol. 106, no. 8, pp. 1523-1526, 2020.

[7] S. E. Williams, "Posterior femoral cutaneous neuropathy in piriformis syndrome: A vascular hypothesis," *Medical Hypotheses,* vol. 144, p. 109924, 2020.

[8] M. M. Koh, "Use of botulinum neurotoxin in the treatment of piriformis syndrome: A systematic review," *Journal of Clinical Orthopaedics and Trauma,* vol. 31, p. 101951, 2022.

[9] B. T. G. MD, "Piriformis syndrome secondary to accessory belly of the piriformis muscle: A rare case report with MRI diagnosis," *Radiology Case Reports,* vol. 19, no. 4, pp. 1503-1505, 2024.

[10] U. Gülsaran, "Evaluation of Accuracy of Shear Wave Elastography and Superb Microvascular Imaging Methods in Diagnosis of Piriformis Syndrome: A Preliminary Study," *Ultrasound in Medicine & Biology,* vol. 48, no. 12, pp. 2521-2529, 2022.

[11] A. Tabatabaei, "Could dry needling change the kinematics of gait in individuals with piriformis muscle syndromes? Secondary analysis of a randomized controlled trial," *Journal of Bodywork and Movement Therapies,* vol. 37, pp. 323-327, 2024.

[12] A. Fahmi, "Complete resolution of recurrent piriformis syndrome after piriformis resection with 3 years' follow up: A case report," *International Journal of Surgery Case Reports,* vol. 77, pp. 576-579, 2020.

[13] F. V. M.D., "Endoscopic Treatment of Piriformis Syndrome Results in a Significant Improvement in Pain Visual Analog Scale Scores," *Arthroscopy, Sports Medicine, and Rehabilitation,* vol. 4, no. 2, pp. e309-e314, 2022.

[14] T. Ahadi, "Comparing radial extracorporeal shockwave therapy and corticosteroid injection in the treatment of piriformis syndrome: A randomized clinical trial," *Journal of Bodywork and Movement Therapies,* vol. 33, pp. 182-188, 2023.

[15] A. Younus, "A minimally invasive open surgical approach for piriformis syndrome. A case report and literature review," *Interdisciplinary Neurosurgery,* vol. 21, p. 100720, 2020.

[16] J. K. Lo, "Chapter 13 - Piriformis syndrome," *Handbook of Clinical Neurology,* vol. 201, pp. 203-226, 2024.

[17] E. Kolovani, "Pyomyositis of piriformis muscle, as a rare cause of deep venous thrombosis," *IDCases,* p. e01089, 24.

[18] E. Koh, "Imaging of peripheral nerve causes of chronic buttock pain and sciatica," *Clinical Radiology,* vol. 76, no. 8, pp. 626.e1-626.e11, 2021.