Original Research Article

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

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Abstract

Background: The total hip prosthesis is expected to perform a mechanical function by transmission of weight load and also transmission of motion. We studied these since they are the two most commonly performed approaches and both provide adequate exposure for total hip replacement. The relative merits of these approaches are debated, although no study has conclusively demonstrated an advantage of one over the other. The issues involved in selecting a surgical approach are addressed in this study. **Materials & Methods:** A prospective study was done in 30 patients undergoing total hip replacement at department of orthopaedic in Patna Medical college, Bihar, India during Sept. 2020 to Sept. 2021. 15 patients underwent lateral muscle splitting approach and 15 underwent posterior gluteal splitting approach. All of them were admitted in special rooms allocated for patients who are to undergo total hip replacement. A detailed history and clinical examination was done. Preoperative assessment of range of movements, pain, function and Trendelenburg test were done. All these patients were examined 3 months postoperatively for assessment. **Results:** The mean age was 55.42 years. The mean follow up was 110.52 days. Preoperative and postoperative Harris Hip Score was obtained to evaluate pain and function. There were significant differences between the lateral and posterior approach. **Conclusion:** We concluded that the functional outcome, gait and Trendelenburg test are equally good results with total hip arthroplasty using either the lateral approach or the posterior approach.

Keywords: THA, Harris Hip Score, Gait, Trendelburg Test, Functional Score.

Introduction

The hip joint is designed for both mobility and stability, allowing the entire lower extremity to move in three planes of motion. The hip provides an important shock absorption function to the torso and upper body as well as stability during standing and other weight-bearing activities[1].

Total hip replacement refers to replacement of a diseased hip joint with an artificial acetabulum and head of femur. It is indicated for arthritis of the hip joint, which usually leads to increase in pain, deteriorating gait and stiffness. Currently it is the procedure of choice for most hip conditions. The extraordinary success of total hip replacements has led to a progressive increase in the number of replacement surgeries done. The clinical research towards various components of hip replacement has led to rapid developments but the choice of approach remains surgeon dictated[1].

The total hip prosthesis is expected to perform a mechanical function by transmission of weight load and also transmission of motion. Not only must low frictional resistance be maintained between a joint but also the torsional force transmitted from the prosthetic femoral head to the socket must be resisted for a successful arthroplasty[2]. Human gait is bipedal, biphasic, forward propulsion of centre of gravity, in which there is alternate sinuous movement of head and body, with least expenditure of energy.

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The primary aim of total hip arthroplasty is to create a stable, functional and painless hip. The success of total hip arthroplasty depends on the ability of the surgeon to achieve adequate surgical exposure while minimizing complications so as to achieve optimal implant position.

There is a difference of opinion among orthopaedic surgeons regarding the best surgical approach for total hip replacement. The proponents of the posterior approach claim better exposure, less blood loss and easy implant positioning without abductor damage but the proponents of lateral approach site a higher rate of dislocation in posterior approach. Today, the most commonly performed approaches to total hip arthroplasty include the abductor muscle splitting lateral approach and the posterior approach[2]. The aim of this study to compared the gait, trendelenburg test and functional outcome between lateral and posterior approaches for primary total hip replacement (THA).

Materials & methods

A prospective study was done in 30 patients undergoing total hip replacement at department of orthopaedic in Patna Medical college, Bihar, India during Sept. 2020 to Sept. 2021.

Inclusion Criteria

Any patient with hip arthritis or unstable hip with
1. Age more than 40 years (Skeletally mature)
2. Normal preoperative electromyography.

Exclusion Criteria

1. Age less than 40 years and more than 80 years
2. Signs of abnormal nerve function

3. Dysplastic hip
4. Neurological disease or history of sciatica with neurological signs.

Methods

Diagnosis included chronic arthritis secondary to primary osteoarthritis[5], tuberculosis[1], avascular necrosis[8], inflammatory conditions namely Ankylosing spondylitis[5], Rheumatoid arthritis [1], and nonunion neck of femur[3].

15 patients underwent lateral muscle splitting approach and 15 underwent posterior gluteal splitting approach. All of them were admitted in special rooms allocated for patients who are to undergo total hip replacement. A detailed history and clinical examination was done. Preoperative assessment of range of movements, pain, function and Trendelenburg test were done.

Surgical procedure

For the lateral approach the patient is positioned supine on a sand bag. The modified Hardinge[3] approach was used in all cases. Make a posteriorly directed lazy-J incision centered over the greater trochanter. Divide the fascia lata in line with the skin incision and centered over the greater trochanter. Retract the tensor fasciae latae anteriorly and the gluteus maximus posteriorly exposing the origin of the vastus lateralis and the insertion of the gluteus medius. Incise the tendon of the gluteus medius obliquely across the greater trochanter leaving the posterior half still attached to the trochanter. Carry the incision proximally in line with the fibers of the gluteus medius at the junction of the anterior and middle thirds of the muscle. Distally, carry the incision posteriorly in line with the fibers of the vastus lateralis down to bone along the anterolateral surface of the femur. Elevate the tendinous insertions of the anterior portions of the gluteus minimus and vastus lateralis muscles. Abduction of the thigh then exposes the anterior capsule of the hip joint. The Capsule is incised and hip dislocated. During closure, repair the tendon of the gluteus medius with nonabsorbable braided sutures.

In Posterior[4] approach, the patient is placed on the unaffected side. Start the incision approximately 10 cm distal to the posterosuperior iliac spine and extend it distally and laterally parallel with the fibers of the gluteus maximus to the posterior margin of the greater trochanter. Then direct the incision distally 10 to 13 cm parallel with the femoral shaft. Expose and divide the deep fascia in line with the skin incision. By blunt dissection separate the fibers of the gluteus maximus; taking care not to disturb the superior gluteal vessels in the proximal part of the exposure. Retract the proximal fibers of the gluteus maximus proximally and expose the greater trochanter. Retract the distal fibers distally and partially divide their insertion into the linea aspera in line with the distal part of the incision. Next, divide the short external rotators at their insertion on the femur and retract the muscles medially. The posterior part of the joint capsule is now well exposed; incise it from distal to proximal along the line of the femoral neck to the rim of the acetabulum.

Flex the thigh and knee 90 degrees, internally rotate the thigh, and dislocate the hip posteriorly.

The femur and acetabulum are reamed to appropriate sizes and the prosthesis is inserted. The use of methylmethacrylate was left to the discretion of the individual surgeon. All patients were placed in an abductor pillow in the operating room. Beginning on the night of surgery, all patients received mechanical prophylaxis for thromboembolism in the form of ankle foot pump exercises and calf muscle squeezing. None of the patients received anticoagulants. Postoperatively, all patients followed a physical therapy regimen while in bed, including isometric knee extension and hip abduction, beginning on the first postoperative day. Ambulation also was permitted on the second postoperative Day after drain removal and radiograph. Patients treated with cemented arthroplasties were allowed full weight-bearing as tolerated with crutches, beginning on the second day after surgery. Patients treated with uncemented arthroplasties were allowed 10 % weight-bearing with crutches, beginning on the second postoperative day. Toe touch weight bearing was continued for six weeks and then progressed to full weight bearing in a gradual manner between six and 12 weeks. Compliance of patients was excellent in all groups.

All these patients were examined 3 months postoperatively for assessment.

The functional outcome of hip surgery is measured using Harris[5] Hip Score. It gives a maximum of 100 points.

The domains include pain (44 points), Function (47 points), Deformity (4 points) and Range of motion (5 points).

Function is subdivided into activities of daily living – 14 points and gait –33 points.

A Score of 90-100 means excellent results, 80-90 being good, 70-79 fair, and below 70 poor. It is assessed before and after surgery to determine improvement. Trendelenburg test was assessed preoperatively and postoperatively.

Visual Gait Analysis was assessed preoperatively and postoperatively using Rivermead visual gait analysis (RVGA) method described by S.E.Lord et al from Rivermead rehabilitation centre, Oxford, UK IN 1998[7]

The RVGA comprises two observations of the arms covering both swing and stance of gait, and 18 observations of the trunk and lower limb: 11 observations during the stance phase and seven during the swing phase of gait. The observations apply only to one side at a time. A four-point scale was used to quantify the degree of abnormality for each of the component items: 0 = normal, 1 = mild, 2 = moderate and 3 = severe. A global score can be calculated by summing the total numbers of deviation scores, range from 0 (normal gait) to 59 (grossly abnormal gait).

Statistical Analysis

All variables in this study were entered into the database and computed using SPSS 21.0 for windows programme and were analyzed statistically, comparing the posterior approach patients with the lateral approach patients. The statistical analysis involved comparing means of various parameters with resultant *p* values that are given with 95% confidence intervals.

Results

Total hip arthroplasties were performed in 30 patients of which 15 underwent Modified Hardinge approach[3] (cemented -5, uncemented -10) and 15 had posterior approach[4] (cemented – 5, uncemented-10). The mean age was 55.42 years. The mean follow up was 110.52 days.

Preoperative and postoperative Harris Hip Score[5] was obtained to evaluate pain and function. There were significant differences between the lateral and posterior approach.

The mean preoperative Harris Hip Score was 44.53 in the lateral group whereas the mean preoperative Harris Hip Score in the posterior group was 32.65. The mean postoperative Harris Hip Score was 78.82 in the lateral group whereas the mean postoperative Score was 88.76 in the posterior group. Overall the mean improvement in Harris Hip score16 in the lateral group was 34.23 and in the posterior group 56.11 (table 1).

Table 1: The comparison of mean Harris Hip Score and Trendelenburg test in lateral and posterior surgical approach

Surgical approaches	Harris Hip Score				Trendelenburg test			
	Pre-op	Post-op	Improvement	P-value	Pre-op	Post-op	Improvement	P-value
Lateral approach (Modified Hardinge score)	44.53±2.66	78.82±5.23	34.23±2.57	<0.05	5.36±0.593	3.28±0.852	2.08±0.316	>0.05
Posterior approach	32.65±3.18	88.76±6.82	56.11±4.63	<0.05	5.73±0.524	2.89±0.821	2.84±0.452	>0.05

Preoperative Trendelenburg test mean score was 5.36 for the lateral group and 5.73 for the posterior group. The postoperative score was 3.28 for the lateral and 2.89 for the posterior groups. The mean improvement in the test was 2.08 for the lateral and 2.84 for the posterior group. Although, there is more improvement in the posterior group than the lateral, the p value was >0.05, which is not significant (Table 1).

Evaluation of gait was performed at the end of 3 months postoperatively. The mean preoperative score was 23.58 for lateral and were 24.28 for posterior groups. Postoperatively the score were 9.12 for lateral and were 6.73 for posterior groups. The overall mean improvement in gait in the lateral group was 14.46 and 17.55 for the posterior group. Although, there is more improvement in the posterior group than the lateral, the p value was >0.05 which is not significant (Table 2).

Table 2: The comparison of mean Gait and Pain in lateral and posterior surgical approach

Surgical approaches	Gait				Pain			
	Pre-op	Post-op	Improvement	P-value	Pre-op	Post-op	Improvement	P-value
Lateral approach (Modified Hardinge score)	23.58±5.20	9.12±2.12	14.46±2.35	>0.05	19.28±4.82	38.83±3.72	19.55±1.05	<0.05
Posterior approach	24.28±5.48	6.73±2.69	17.55±3.66	>0.05	15.56±5.13	41.26±4.42	25.7±1.12	<0.05

Mean Pain scores before surgery were 19.28 for lateral and 15.56 for posterior groups. After surgery pain score were 38.83 for lateral and 41.26 for posterior groups. The mean improvement of pain in lateral group was 19.55 and in the posterior group were 25.7. The p value for the pain score was <0.05*, which are significant (table 2).

Mean Function scores preoperatively were 22.43 for lateral and were 14.18 for posterior groups. Postoperative function score were 34.26 for lateral and 42.53 for posterior (Table 3).

Table 3: The comparison of mean functional score in lateral and posterior surgical approach

Surgical approaches	Functional Score			
	Pre-op	Post-op	Improvement	P-value
Lateral approach (Modified Hardinge score)	22.43±5.28	34.26±4.15	11.83±1.96	<0.05
Posterior approach	14.18±8.23	42.53±5.10	28.35±3.47	<0.05

Post operative assessment was done at the end of 3 months. The p value for function score was .005 both of which are significant. When compared with the preoperative hip scores, significant improvement was appreciated in the posterior group when compared to lateral group.

Discussion

Many surgical approaches are used in total hip replacement. Two of the most popular are the posterior[4] and the lateral (Modified Hardinge type)[3] approaches. We studied these since they are the two most commonly performed approaches and both provide adequate exposure for total hip replacement. The posterior approach is generally considered to be easy to perform, using less extensive tissue dissection, which gives shorter operation times, and less blood loss. It allows a good exposure of the femur that may reduce the risk of femoral fracture during the procedure. It is considered to be associated with less problems with gait since the abductor muscles are not dissected. However, it is often more difficult to see the acetabulum and increased rates of dislocation have been reported[7]. It also has higher incidences of sciatic nerve injury and femoral stem loosening[8].

The advantages proposed for the direct lateral approach are that it allows good exposure of the acetabulum, facilitating cup positioning which may decrease rates of hip dislocation. It also diminishes the risk of injury to the sciatic nerve, which is not close to the operative field. However, there is an increased risk of damage to the superior gluteal nerve[9] as well as to the gluteus medius muscle resulting in delay in recovery of abductor strength and late Trendelenburg gait. Also, the supine position provides excellent exposure to the acetabulum, allows exact acetabular orientation and direct limb length measurement. Furthermore, the capsule of the hip joint is preserved. Though not confirmed there is a likelihood of heterotropic ossification with this approach.

The primary goal of total hip arthroplasty is to improve pain and function. Barber[2] in 1996 compared 28 total hip replacements operated on using the posterior approach versus 21 hips using the direct lateral approach. Cemented and uncemented implants were used in both approaches in different proportions. At 2 years follow-up, no dislocations were recorded in either group. A Trendelenburg test score as well as a limp score and an abductor power score were recorded without significant differences between groups. This is the only study which assessed Harris hip score and found both groups improved their postoperative score to obtain the same mean score of 94 at the end of 2 years and found it is not significant.

In this study we used Harris hip score to evaluate the preoperative and postoperative outcome. We assessed at the end of 3 months for comparing the early functional outcome between the lateral and posterior approaches. Though there is a significant improvement in the overall score as well as individual pain and functional score, it is of doubtful significance.

Mulliken et al (1998)[10], in a review of 770 total hip replacements via the lateral approach, found a 10% incidence of moderate or severe limp at 2 years, but there was no comparative posterior approach group.Baker and Bitounis (1989)[9] found more positive postoperative Trendelenburg tests after the lateral approach than after the posterior one and considered that this weakness was due to detachment of the gluteal flap, although they did not quantify abductor strength. In addition, violation of the 'safe zone' (Comstock et al. 1994)[11] within 5 cm of the greater trochanter may damage the superior gluteal nerve and thus further risk of abductor muscle weakness[12].

The presence of a postoperative Trendelenburg gait was studied by Baker[9] 1989, Barber[2] 1996 and Downing[13] 2001. These indicate no significant difference between posterior versus direct lateral surgical approach.

In our prospective study of the two approaches, we found postoperative Trendelenburg test slightly seems to favour posterior group but statistically insignificant. However, the results should be taken with care as all the patients were not compared at the same follow-up times. We have also been unable to show any significant difference in results of the Trendelenburg test between the two approaches.

Conclusion

We concluded that the functional outcome, gait and Trendelenburg test are equally good results with total hip arthroplasty using either the lateral approach or the posterior approach.

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