

Total Hip Arthroplasty: Anterolateral Approach Versus Posterior Approach

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Abstract

Background and objectives:Total hip arthroplasty is a popular successful surgical procedure for end stage hip pathologies. Since the introduction of total hip arthroplasty, many surgical approaches have been used; each has its own advantages and disadvantages. The aim of this study was to compare the intraoperative and post-operative complications of anterolateral (Watson-Jones) versus posterior (Moore) approaches for primary total hip arthroplasty. **Methods:** forty-one patients were selected and enrolled into two groups; 22 patients had total hip arthroplasty through posterior approach and 19 patients had anterolateral approach. The patients were followed-up for an average of six months, and each patient was assessed through observation of intraoperative neurovascular injury and femoral fracture, and postoperative pain, dislocation, limping and heterotopic ossification. **Results:** The main complications of the posterior approach were intraoperative sciatic nerve injury (4.9%) and postoperative dislocation (4.9%), while the anterolateral approach associated with higher rates of intraoperative femoral fracture (2.4%) and postoperative abductor weakness and limping (4.9%). **Conclusions:**Current study does not demonstrate any superiority of either approach. Therefore, we think the choice of surgical approach for total hip arthroplasty would be better if based on patient characteristics, surgeon experience and patient preference.

Keywords: Anterolateral approach; Posterior approach; Hip arthroplasty; Dislocation.

Introduction

Total hip arthroplasty (THA) was discovered by Sir John Charnley at 1960s, and then it became a popular surgical treatment to relieve joint pain and restore function¹. Despite its substantial clinical success, THA also has potential major complications like dislocation². Moreover, other reported complications of THA are neurovascular damage, postoperative limping, and implant malalignment³. One of the most important factors that greatly increase the probability of successful outcomes is the choice of surgical approach^{3,4}. Various surgical approaches for THA have been described with various names; two of the most commonly used approaches are the anterolateral (Watson-Jones) and the posterior (Southern, Moore, Gibson, or posterolateral) approaches⁵⁻⁹. After the introduction of THA, each of its approaches has been frequently modified^{4,8}.

The posterior approach to the hip was popularized by Moore⁶ and it is a split through gluteus maximus posterior to the gluteus medius and minimus followed by the division of the posterior hip capsule and the external rotators. The approach is associated with shorter operative

time without damaging the gluteus medius and minimus, and a low rate of postoperative limping and abductor dysfunction^{4,6,7,10,11}. Furthermore, the anterolateral approach first described by Watson-Jones¹¹ and it uses the interval between the tensor fascia lata and the gluteus medius, and sometimes the anterior fibers of the gluteus medius at their insertion on anterior greater trochanter are reflected to facilitate exposure of the proximal femur. In the latter approach, the superior gluteal nerve is at risk because it is five cm (centimeter) proximal to the tip of greater trochanter, and it has a low dislocation rate with a higher postoperative abductor dysfunction^{4,7,10-12}. Discussions and arguments continue between orthopedic surgeons regarding the choice of surgical approach for primary THA because both of these approaches have advantages and disadvantages⁵.

The main purpose of our study was to evaluate the influences of the surgical approaches — anterolateral (Watson-Jones) and posterior (Moore) approaches — on both intraoperative and postoperative complications.

Patients and methods

A prospective cohort study carried out on 41 patients (21 Male and 20 female) in Sulaymaniyah Teaching Hospital who underwent primary THA from June 2016 to September 2017. The patients were randomly divided into two groups; 19 patients underwent THA through anterolateral approach in supine position on an ordinary operative table and 22 patients through posterior approach in lateral position. All the surgeries were performed by two orthopedic surgeons who used cementless components of the same prostheses system.

Inclusion criteria: primary hip osteoarthritis, traumatic fracture of femoral neck and head, and femoral head osteonecrosis.

Exclusion criteria: inflammatory hip arthritis, hip dysplasia, neuromuscular disorder, severe knee osteoarthritis or contractures and previous surgeries on the same hip.

After the agreement of the ethical committee of the Kurdistan Board for Medical Specialties and taking patients' consent, the data were collected using direct interview and clinical examination with the review of the operative notes, imaging and investigations. Preoperative antibiotic prophylaxis and postoperative thromboprophylaxis were given according to the local protocols.

During the first postoperative day, the patients were examined for limb alignment, length discrepancy, and sciatic nerve injury. Physiotherapy started at the first postoperative day with active hip and knee movements and immediate partial weight bearing was commenced. Postoperative radiographs were taken to see the alignments and occult fractures if any. Additionally, patients without any complications were discharged on the fourth postoperative day but the others remained at the hospital. They all were fol-

lowed up to six months.

The follow up was in four visits; at three weeks, six weeks, three months and six months, and the patients were assessed through history, clinical examination and plain radiograph. The approach-related problems including dislocation, pain, abductor weakness (Trendelenburg sign and Gait), infection, and heterotopic ossification, any technical faults like component malpositioning and significant limb length discrepancy were assessed. Sequentially, at sixth postoperative week the pain was assessed by using visual analogue scale (VAS) (from 0-10; 0=no pain, 10=severe pain).

The "IBM SPSS Statistics version 20" was used for the data analysis. Moreover, a P-value ≤ 0.05 was considered statistically significant.

Results

The genders of the patients were 21 (51.2%) male and 20 (48.8%) female patients with a mean \pm SD (Standard Deviation) age of 60.3 \pm 12.4 years (ranged from 28 to 86 years). The main indications for the THA were 29 (70.7%) primary osteoarthritis, 9 (22%) avascular necrosis and 3 (7.3%) femoral neck fracture.

The main intraoperative complications were proximal femoral fracture of 1 (2.4%) patient in anterolateral approach while 2 (4.9%) patients with sciatic nerve injury in posterior approach, Table 1. Furthermore, the main postoperative complications were dislocation in 2 (4.9%) patients after posterior approach and abductor dysfunction in 2 (4.9%) patients of anterolateral approach, Table 2.

The pain score for all patients ranged from one to five with mean \pm SD of 2.6 \pm 0.9, Table 3.

Discussion

Total hip arthroplasty (THA) is a successful operation but

Table (1): Relationship between the approaches and intraoperative complications

Approach	Intraoperative complication			Total	p-value
	Sciatic nerve injury	Fracture	None		
Anterolateral	0 (0%)	1 (2.4%)	18 (43.9%)	19 (46.3%)	
Posterior	2 (4.9%)	0 (0%)	20 (48.8%)	22 (53.7%)	<0.001
Total	2 (4.9%)	1 (2.4%)	38 (92.7%)	41 (100%)	

Table (2): Relationship between the surgical approaches and their outcomes

Approach	Outcome					Total	p-value
	Infection	Limping	Trendelenburg sign	Dislocation	No complication		
Anterolateral	1 (2.4%)	2 (4.9%)	2 (4.9%)	1 (2.4%)	13 (31.7%)	19 (46.3%)	
Posterior	2 (4.9%)	2 (4.9%)	0 (0%)	2 (4.9%)	16 (39%)	22 (53.7%)	
Total	3 (7.3%)	4 (9.8%)	2 (4.9%)	3 (7.3%)	29 (70.7%)	41 (100%)	<0.001

Table (3): Relationship between the approaches and the severity of pain at six postoperative weeks

Pain score (0-10)	Approach		Total	p-value
	Anterolateral	Posterior		
1	0 (0%)	2 (4.9%)	2 (4.9%)	
2	10 (24.4%)	9 (22%)	19 (46.3%)	
3	6 (14.6%)	8 (19.5%)	14 (34.1%)	<0.001
4	2 (4.9%)	3 (7.3%)	5 (12.2%)	
5	1 (2.4%)	0 (0%)	1 (2.4%)	
Total	19 (46.3%)	22 (53.7%)	41 (100%)	

it is associated with different intraoperative and postoperative complications. Several factors affect the outcome of THA such as patients' activity level, comorbidity, component design, surgical technique, and postoperative rehabilitation. Moreover, the effect of surgical technique could not be neglected. Several studies evaluated the influence of surgical approach on the outcomes of THA^{1, 9, 13-15}. According to a survey, the posterior approach is the most commonly used approach worldwide^{11, 15-17}. Posterior approach provides adequate exposure of acetabulum and proximal femur, and the main disadvantage is the higher dislocation rate^{6, 17}. The advantages of anterolateral approach are the decreased incidence of dislocations and providing good exposure of the acetabulum, but the disadvantages are abductor weakness and postoperative limping^{5, 17, 18}. The above factors encouraged us to compare these two approaches to identify which approach is better. Total hip arthroplasty (THA) is a major operation and may face with many complications. One of its complications include nerve injury which is around 0.7-3.5%^{6, 19, 20}. Moreover, sciatic nerves is the most common — 79% of all cases of neurological damage —; peroneal portion is involved more than tibial portion^{19, 21}. Other nerves involved are femoral nerve (0.1-0.2%)^{19, 22}, superior gluteal nerve, and lateral femoral cutaneous nerve⁶. Additionally, posterior approach is associated with greater risk of sciatic nerve injury⁶. Causes for nerve injuries includes: direct

injury, traction due to lengthening of the limb, thermal injury from bone cement, and pressure due to a hematoma, and in about 40% of the cases the cause of injury remains unknown^{6, 19, 23}. This study showed sciatic nerve injury in 2 (4.9%) patients after posterior approach; one of them was completely recovered after three months and in the other patient there was a partial laceration of the sciatic nerve after surgical exploration. We found that there was a statistically very high relationship between surgical approach and intraoperative complications.

Major vascular injury is a disastrous complication of any surgery. The frequency of vascular injury in total hip arthroplasty is very low (0.1-0.2%)¹⁹. In our study we did not face this complication in either approach.

Intraoperative fractures can be a devastating complication resulting in technical difficulties, prolonged functional recovery and poor patient outcomes⁶. Its incidence during primary THA is about 3-18% with higher percentage in anterolateral approach (4.82%) compared with posterior one (1.40%)²⁴. This could be explained by difficult exposure and preparation of the femur through anterolateral approach compared to the posterior one^{5, 24}. Moreover, these fractures occur commonly during femoral canal preparation or insertion of a press fit implant²⁴. The current study showed 1 (2.4%) intraoperative proximal femoral fracture which happened in the anterolateral approach group. The patient was a 46-year-old man with osteonecrosis; a longitudinal

split fracture happened during femoral stem insertion and it was fixed with a cerclage cable. Additionally, we faced no fracture in the posterior approach. We believe that the position of the patient was the cause for bone fracture in anterolateral approach because we had no special table for this approach. A reasonable factor to reduce intraoperative femoral fracture is proper examination of the soft tissue tension before and after manipulation of the leg during surgical procedure⁶.

During immediate postoperative period pain is severe and requires a potent analgesia but gradually it decreases in severity. Sequentially, 83% of the patients will have no pain or mild pain at sixth month after surgery, and a moderate to severe pain with functional limitations is rare²⁵. Anatomical difference may be the cause of different postoperative pain intensity in different surgical approaches, thence, the pain may be due to soft tissue damage^{6, 26}. In the current study, we used VAS to assess the severity of pain at sixth week postoperatively and the result was ranged from one to five degree(s) (mild to moderate) with a mean \pm SD = 2.6 \pm 0.9. Moreover, the pain score was higher after posterior approach and there was a very highly significant statistical relationship between the approaches and postoperative pain severity. There were differences in literatures about which approach will make the patients suffer more from pain; some found that the anterior approach will suffer less¹⁵ and some found no difference between the two^{8, 26}. Thus, the postoperative pain is not the issue of surgical approach alone; other factors such as preoperative neuropathic pain may affect its severity²⁷. One of the early complications of THA is dislocation and it accounts for about 0.4-11%⁴. Moreover, most of dislocations occurred during the first three months after the operation³⁴. The causes can be classified as patient's factors, prosthesis's factors and surgical factors^{4, 18}. In the literature we searched, most of them reveal a higher dislocation rate in posterior approach^{1, 3, 8, 9, 10, 18, 29, 34}. Additionally, a study showed 3.2% dislocation for the posterior approach and 2.2% for the anterolateral approach⁴. The higher rates of dislocation in posterior approach was thought to be related to the compromise of posterior soft tissue stabilizers and some suggested it might be because of inadequate acetabular exposure and subsequent mal-

position of the acetabular component¹⁰. Moreover, some suggested that the rate of dislocation can be decreased by proper soft tissue repair (of capsule and short rotators) in the posterior approach³⁰. Our results showed approximately near results; 4.9% in posterior approach and 2.4% in anterolateral approach with a statistically very highly significant relationship between the dislocation and operative approaches. All the cases with dislocations in our study occurred within eight weeks postoperatively; two cases were treated with close reduction under anesthesia and one case in the posterior approach group ended with revision. In the literature we searched, there was a higher rate of dislocation after THA in trauma patients; 6% for trauma patients, 0.25% in patients with osteoarthritis, and 0% in patients with avascular necrosis (AVN)³. Furthermore, we did not observed such correlation between the preoperative diagnosis and dislocation; we found 0% in patients with femoral neck fracture, 2.4% in patients with primary OA, and 4.9% AVN.

Limping is another serious complication of THA⁶ and it is more common after anterolateral and lateral approaches³¹. Furthermore, limping in the literature was accounted for 7.4% after anterolateral approach and 3.8% after the posterior approach⁸. In our study, we examined the patients for abductor function by static Trendelenburg sign and gait pattern at third and sixth month following surgery after exclusion of significant limb length discrepancy and pain as a cause of limping 4 (9.8%) of the patients had limping with equal distribution among the two groups. Moreover, 2 (4.9%) of them were having positive Trendelenburg sign in both occasions after anterolateral approach but no patients were found with the same sign after posterior approach. Anterolateral approach associated with abductor muscle dysfunction leads to Trendelenburg sign, altered gait and peritrochanteric pain^{6, 9, 32, 33}. Furthermore, the cause for the weakness was considered to be due to the detachment of the anterior fibers of abductors and damage to the superior gluteal nerve^{5, 9, 12, 33, 34}. As we did not use electromyography to test the abductor function, we could not find whether abductor weakness was due to gluteal muscle denervation or muscle damage. The risk of this complication could be decreased by using minimal invasive anterolateral technique without effect on the positioning of the implants³⁵.

³⁶ and if occurred, it will improve with time after regaining abductor strength within 3-12 months postoperatively¹² although we could not prove it because of short follow up duration.

Heterotopic Ossification (HO) is a common disabling complication of THA and the incidence ranges from 5-90%^{37, 38}. Moreover, the rate of clinically significant HO (Brooker grade III and IV) which causes functional impairment is 9%^{38, 39}. Additionally, the posterior approach was associated with a lower rate of HO than the anterolateral^{40, 41, 42}. The causes could be the amount of soft tissue damage, bone debris and operative time^{38, 43}. Despite the high rates of HO in the literatures, we could not find any patient with HO during the six months follow up; it may be due to meticulous soft tissue dissection we performed.

Finally, other minor complication in our study was superficial surgical site infection; 1 (2.4%) in anterolateral and 2 (4.9%) in posterior approaches. Furthermore, they were treated with intravenous antibiotics and daily dressing.

Conclusions

The influence of the surgical approach on the outcome of the THA is a debatable issue. Based on the current study, both anterolateral and posterior approaches have advantages and disadvantages; therefore, the surgical approach is the surgeons' choice and patient's preference. Moreover, we recommend choosing the approach that the surgeon has more experience with. Additionally, a skillful practice, meticulous tissue dissection, and proper soft tissue repair can reduce the postoperative complications and improve the outcomes.

We recommend studying a larger sample size and longer duration of follow up to find the differences between the approaches and their superiority.

Conflict of interest

Nothing to declare

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