Research Article ISSN 2639-9474

Nursing & Primary Care

A Systematic Review of Functional Outcome after Lateral Surgical Approach for Total Hip Arthroplasty

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Received: 11 Jul 2023; **Accepted:** 24 Aug 2023; **Published:** 31 Aug 2023

Citation: Faisal M A, Chowdhury A Z, Kundu I K. A Systematic Review of Functional Outcome after Lateral Surgical Approach for Total Hip Arthroplasty. Nur Primary Care. 2023; 7(5): 1-5.

ABSTRACT

Introduction: *Osteoarthritis affects 10% of the population, primarily affecting weight-bearing joints such the hips (5%) and other joints. A total hip arthroplasty (THA) is typically required (2.5% of persons between the ages of 40 and 84) as a result of worsening gait, rising pain, and stiffness. There have been many different surgical methods for the hip mentioned. The posterior and direct lateral approaches are currently the main THA techniques. The direct lateral method is said to have the advantage of allowing good acetabular exposure and simplifying cup alignment, which may lower hip dislocation rates. Additionally, it reduces the chance of damaging the sciatic nerve far from the surgical site.*

Materials and Methods: *The prospective study on 25 patients with unilateral osteoarthritis, aged 25 to 60 years was carried out at Department of Orthopaedic surgery, Bangabandhu Sheikh Mujib Medical University and different private hospital at Dhaka, Bangladesh from September 2020 to March 2023 where outcome of uncemented THR by Direct Lateral approach was recorded. Evaluation of the results was done the day before the procedure as well as one month, three months, six months, and twelve months thereafter.*

Aim: *The main objective was to find out functional outcome of patients after total hip arthroplasty by direct lateral approach.*

Results: *Total 25 Patients with unilateral osteoarthritis have undergone uncemented total hip arthroplasty by Lateral approach, n= 25; 12(48%) were female and 13 (52%) were male. The mean age of patients was 42.5 years range from 25-60 years. Right Side was predominantly affected in all cases. VAS, HHS and WOMAC scores significantly improved at the follow-up after THA by the LA (all $p < 0.05$). A VAS score preoperatively was 8.7 which was improved 2.5 at 12 months follow up with significant p value <0.001.*

Conclusion: *Patients who had Total Hip Arthroplasty performed with the Lateral Approach reported significiant improvement in functional outcomes with less postoperative muscle damage, stiffness, and pain during daily activities.*

Keywords
Osteoarthritis, Total hip arthroplasty (THA), Surgical approach, Hardinge transgluteal direct lateral approach (LA) and functional outcome.

Introduction
According to Hoaglund [1], osteoarthritis affects 10% of the population, primarily affecting weight-bearing joints such the hips (5%) and other joints. Hip osteoarthritis is characterized by articular cartilage loss in the hip joint. It could be primary, meaning it's idiopathic, or secondary, meaning it happened after hip disorders in childhood, trauma, osteonecrosis, an earlier joint infection, or another ailment. Hip osteoarthritis is a degenerative disease for which there is no treatment. A total hip arthroplasty (THA) is typically required (2.5% of persons between the ages of 40 and 84) as a result of worsening gait, rising pain, and stiffness. A total hip replacement (THA) involves replacing the acetabulum and femoral head with prosthetic implants (cup, head, and stem). There have been many different surgical methods for the hip mentioned. The posterior and direct lateral approaches are currently the main THA techniques [2,3]. The greater trochanter is the focal point of a longitudinal skin incision used in the direct lateral approach. In the line of the incision, the iliotibial band and gluteal fascia are exposed and divided. The vastus lateralis is extended distally through the insertion of the gluteus medius, which is then medially with the insertion of the anterior gluteus minimus. It is possible to incise or excise the hip capsule once it is visible. The direct lateral method is said to have the advantage of allowing good acetabular exposure and simplifying cup alignment, which may lower hip dislocation rates. Additionally, it reduces the chance of damaging the sciatic nerve far from the surgical site. However, problems with limping are more likely to come from injury to the gluteus medius muscle and superior gluteal nerve [4-6]. Long stem insertion or additional correction using the same method are likewise more challenging. According to Mulliken [7], there have been more reports of heterotopic ossifications.

Material and Methods
The prospective study on 25 patients with unilateral osteoarthritis, aged 25 to 60years was carried out at Department of Orthopaedic surgery, Bangabandhu Sheikh Mujib Medical University and different private hospital at Dhaka, Bangladesh from September 2020 to March 2023 where outcome of uncemented THR by Direct Lateral approach was recorded.

An evaluation of the results was done the day before the procedure as well as one month, three months, six months, and twelve months thereafter.

Surgical Technique
Participants who had primary osteoarthritis the cementless total hip arthroplasty (THA) was considered appropriate for all of the study's surgical treatments and following follow-up took place at Bangabandhu Sheikh Mujib Medical University's Department of Orthopaedic Surgery on each patient. Utilizing the program trauma card, preoperative templating was done. The patients were placed in a lateral decubitus position during the procedure. They all received the exact identical cementless parts: Bi-metric stems with Exceed ABT Ringloc-x shells and metal heads in sizes 32 or 36 mm. An equal leg length and the femoral offset were restored with the help of templating [8]. According to Lewinnek et al., the surgeons tried to position the cup within 5-15° of anteversion and 30-50° of inclination. During the hospital stay, all patients received thromboprophylaxis, pre- and postoperative antibiotics.

Table 1: Outlines the requirements for both including and excluding criteria of patients selection.

Inclusion criteria:	Exclusion criteria:
✓ Aged 25–60 years ✓ Diagnosed with unilateral primary hip osteoarthritis (OA) or secondary OA due to mild hip dysplasia (center-edge angle > 20°) ✓ Scheduled for primary cementless total hip arthroplasty.	✓ Previous total joint arthroplasty at any joint (hip, knee, or ankle), or significant lower limb surgery, still causing symptoms. ✓ Symptoms in multiple joints (hip, knee, or ankle) with anticipated complete joint replacement within 1 year. ✓ BMI > 35 ✓ Any physical impairment that prevents the patient from walking unassisted without assistance ✓ Any serious medical illness that impairs physical function, such as chronic heart failure or chronic obstructive pulmonary disease, severe dementia (OMC 18), or any neurological disorder (such as cerebral thrombosis, Parkinson's disease). ✓ Inability to understand both written and oral instructions in bengali language. ✓ Does not wish to participate.

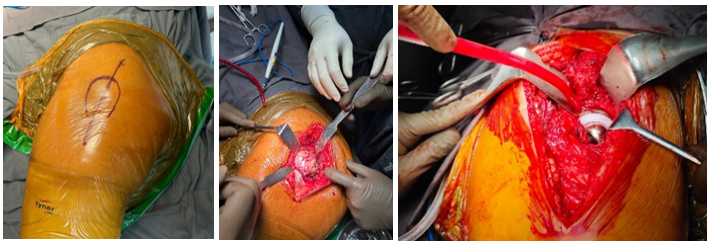
*OMC = Orientation–Memory–Concentration Test.

Lateral Approach
We employed the direct lateral approach for our surgeries, following the technique described by Hardinge K et al. [9] The lateral approach (LA) involved making a midline incision over the greater trochanter. During the procedure, the anterior one-third of the gluteus medius insertion and the gluteus minimus insertion at the tip of the greater trochanter were detached. Excision of the hip capsule was performed on the anterior side of the joint, extending from the base of the femoral neck to the rim of the acetabulum. To dislocate the hip, external rotation, adduction, and flexion maneuvers were employed. During wound closure, the previously detached portions of the gluteus medius and minimus were reinserted using a thick absorbable suture (specifically, coated VICRYL® size 2) to approximate the divided gluteus minimus and the anterior flap of the gluteus medius.Capsular repair was performed using a same suture (specifically, coated VICRYL® size 2).

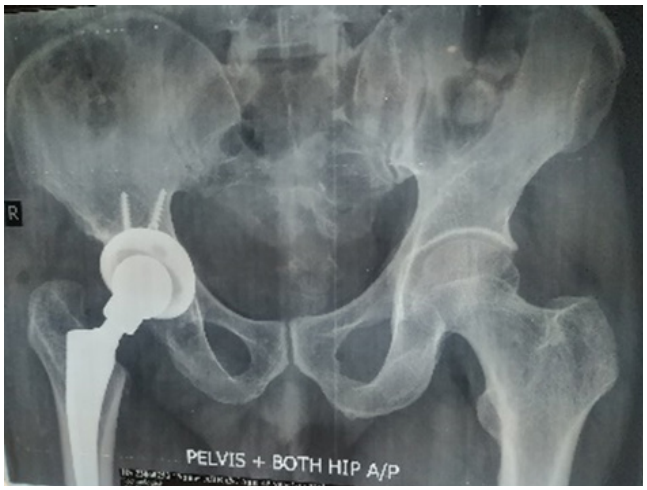
Pictures

Pre-op X-ray

Per-operative



Post-operative



Post operative Rehabilitation

All patient's limb was positioned approximately 15 degree of abduction by using pillow in between legs, Flexion, adduction and internal rotation was prohibited. Each patient was instructed to get up from bed and sit on edge of the couch, Chest physiotherapy at 1st POD, isometric Quadriceps & hamstring Strengthening exercise and active movement of ankle and toes as early as pain permits, 2nd POD check dressing and drain Off in all cases followed by Check X-ray. All patients were allowed to walked at least for 10-20 minutes from 3rd POD as pain permits, twice a day. Patients were usually discharged at 5-7th POD. Stitches were removed at 14th POD. Following discharge, all patients practiced walking while fully supported by two crutches and underwent individualized physical treatment. Hip flexion was restricted to 90 degrees during the first four weeks, and forceful internal and external rotation was not permitted.

Advice at discharge: -

1. To do abduction and extension exercises of the hip and quadriceps exercises of the knee at least up to 3 months.
2. Using high commode and to use table and chair for prayer and avoid squatting (hip flexion & lt; 90 degree).
3. Patients are advised to walk with the aid of a walker for 4-6 weeks, and gradually increase weight bearing, until adequate strength and confidence is gained, then he /she can walk without aid.

Patients with sedentary occupation can return to work after 6 to 8 weeks.

Statistical Analysis

Using SPSS (version 12.0 for Windows), an independent biometrician (F.K.) carried out all numerical and graphical analyses. For continuous endpoints, medians, minima, and maxima were used; for categorical endpoints, absolute and relative frequencies were used. Accordingly, nonparametric box whisker plots were used as a basis for the graphical display of continuous data. The distribution of intraindividual differences served as the foundation for the depiction of intraindividual comparisons in continuous endpoints at various assessment dates. The Sign test was used to determine the significance of these intraindividual comparisons at continuous endpoints. The two sample Wilcoxon test was used for continuous endpoints (as the main clinical endpoint) and the Fisher test for categorical endpoints when comparing sub samples. P-values were used to summarize the results of significance tests. Therefore, analysis of the primary research hypothesis of this investigation was based on the descriptive comparison of the primary clinical endpoint (HHS increase after 12 weeks) between the posterior and lateral treatment groups as well as on the derivation of a two-sided Wilcoxon test p-value (as suggested by the Statistical Analysis Plan of the trial). Because statistical outliers could not be completely ruled out during the development of the trial's statistical analysis plan, the confirmatory analysis directly focused on the application of the two sample Wilcoxon test, departing from the t-test assumption introduced into the sample size calculation. When compared to its two sample t-test analog, the latter exhibits a gradually declining statistical power, but the more reliable. Although it exhibits progressively less statistical power than its two sample t-test counterpart, the latter's more reliable management of potential outliers was seen to be a decisive advantage. Due to the exploratory nature of these studies, if additional significance tests are carried out in the context of subsequent exploratory analyses, the resulting p-values were not multiplicity-adjusted; hence, a p-value of less than 0.05 denotes

locally statistical significance.

Functional Independence and Health-Related Quality of Life Assessment

The Western Ontario and McMaster Universities (WOMAC) questionnaire, a self-administered disease-specific validated outcome measure, was used to assess pain, stiffness, and physical function disability in patients with knee and hip osteoarthritis [10-12] and was administered to each patient both before surgery and at the last follow-up. The WOMAC questionnaire provides either single domain scores or a total score (0–100); lower scores are associated with less pain and stiffness and better function.

Functional assessment

Each patient had preoperative and postoperative assessments using the Harris Hip Score (HHS) and Visual Analog Scale (VAS) [13]. A disease-specific exam called the Hip Disability Score (HHS) is used to assess hip disability [14]. Its scores range from 0 to 100 and assess domains such as pain, function, deformity, and motion. A total score below 70 was seen to be poor, 70 to 79 fair, 80 to 89 good, and 90 to 100 excellent [10]. The recovery rate (RR) was calculated using the following formula: [RR = (postoperative value -preoperative value)/postoperative value x 100] to gauge the level of HHS improvement. [15]. Pain perception was assessed subjectively using the VAS. A VAS score of 3 or above at the most recent follow-up indicated the presence of residual pain [16]. THAs with known sources of pain (such as infections, stiffness or loosening, instability, a fracture, a neurovascular injury, or comorbidities) were excluded from the analysis for the sole aim of determining the presence of residual pain.

Results:

The demographic data shown in (Table 1) among total 25 patients who had uncemented total hip arthroplasty by Lateral approach, n= 25; 12(48%) were female and 13 (52%) were male. The mean age of patients was 42.5 years range from 25-60 years. Right Side was predominantly affected. Three months following surgery, patients who underwent a direct lateral approach displayed a median total range of motion of 210° (150°–260°), as opposed to 190° (145°–255°) in the posterior group of patients (Wilcoxon p = 0.105).

Table 2/3 shows the differences between HHS, VAS, and WOMAC scores before surgery and at follow-up. VAS, HHS and WOMAC scores significantly improved at the follow-up for the LA and (all p < 0.05). We found lower HHS, VAS and WOMAC scores in the LA group. A VAS score preoperatively 8.7 in LA which was improved to 2.5 at 12 months follow up with significant p value <0.001.

Table 3 shows WOMAC sub-scores related to pain, stiffness, and daily life activities. Postoperative Pain status, Stiffness and return to daily activity was excellent in all patients operated by direct lateral approach (all p <0.001).

Table 1: Demographic status of Patients.

	Lateral approach
Study population, n	25
Age, mean (range)	42.5 (25–60)
Female, n	12 (48%)
Male	13 (52%)
Side	
Right	15 (60%)
Left	10 (40%)
Diagnosis	
Osteonecrosis	12
Osteoarthritis	13

Table 2: The distributions of the total HHS scores before and one, three, six, and twelve months after direct lateral THA are shown in Table 2. Also shown are the medians of the corresponding intraindividual change distributions (post - preoperative) and the corresponding p-values from the Wilcoxon test of two samples at each assessment time. Preoperative VAS score for pain and 12-month follow-up.

Total HHS Score

Approach	Preoperative	1 month	3 months	6 Months	12 months
Direct Lateral	47 (29-76)	52 (35-72)	62 (44-80)	80 (65-82)	90 (78-93)
P-Value	0.307	0.05	0.031	0.025	0.012

Change In Total HHS Score (Post – Preoperative)

Approach	1 months	6 months	12 Months
Direct Lateral	5 (-6; 18)	33 (15; 36)	43 (20; 46)
P-Value	0.041	0.03	0.012

VAS pain Score

	Direct Lateral
preop	8.7
12 moths follow-up	2.5
p-value	< 0.001

Table 3: The WOMAC sub-scores for pain, stiffness, and daily activities; Table 3 shows the median values, lowest and maximum values. The ratings are 0 to 100%, with 100% being the highest possible score. The table displays the scores prior to the procedure as well as one, six, and twelve months following the posterior and direct lateral approaches. The two-sample Wilcoxon test, which was used to compare the results between the two procedures at each assessment period, was used to determine the p-values in the table.

Womac Sub Scores [0 – 100%]	Approach	Preopera-tive	1 months	6 months	12 months
Pain	Direct Lateral	47 (0-80)	78 (0-100)	84 (0-100)	92 (0-100)
	P-Value	0.383	0.053	< 0.001	< 0.001
Stiffness	Direct Lateral	45 (0-80)	75 (10-100)	80 (20-100)	88 (20-100)
	P-Value	0.313	0.053	< 0.001	< 0.001
Daily Activity	Direct Lateral	47 (0-76)	73 (0-90)	82 (0-96)	92 (0-100)
	P-Value	0.479	0.050	< 0.001	< 0.001

Discussion

The Direct lateral approach is one of the most common surgical approaches performed worldwide for THA. We have included 25 patients who underwent cementless THA by direct lateral

approach. We found male predominance and the mean age of patients was 42.5 years range from 25-60 years. Right Side was predominantly affected which is similar with the result of previous study Witzleb W-C et al. [14]

In our study the differences between HHS, VAS, and WOMAC scores before surgery and at follow-up was recorded. VAS, HHS and WOMAC scores significantly improved at the follow-up for lateral approach (all $p < 0.05$).

In our sample, a greater preoperative HHS and postoperative HHS was found in lateral approach. With good to excellent clinical results seen in patients in the lateral approach, the HHS significantly improved following surgery. The improvement in HHS for lateral approach was also greater than the minimal clinically significant difference reported by Singh et al. following primary THA. Similar results with comparable mean postoperative HHSs with lateral approach were presented by Ji et al. [17].

A VAS score preoperatively was 8.7 in lateral approach which was improved to 2.5 at 12 months follow up with significant p value <0.001. Similar to Putananon C et al. [18]. We noted that the patients had lower residual pain at follow-up. Further analysis of the residual pain confirmed better results in the patients.

In this study, WOMAC sub-scores related to pain, stiffness, and daily life activities. Postoperative Pain status, Stiffness and return to daily activity was excellent in all patients operated by lateral approach (all p <0.001) which is similar with the result of previous study Mariconda M et al. [19].

In this study, 1-year follow-up, patients who underwent THA using the lateral Approach reported greater improvement in Functional outcome and lower residual pain as assessed by HHS, VAS and WOMAC scores, which is similar to previous study.

Conclusion

Total hip arthroplasty performed with the Direct lateral approach reported Significant improvements in functional outcomes, less postoperative muscle damage, residual pain, stiffness, and daily activity indicators.

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