

Comparing the outcome of lateral versus posterior approach for hemi-replacement arthroplasty for neck of femur fracture: A randomised controlled trial

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Abstract

Background: Among commonly used approaches, posterior approach (Moore's) results in better regain of function as it require less muscle dissection, while the lateral approach (Hardinge's) has a lower risk of dislocation.

Objectives: To compare the functional outcome between lateral and posterior approaches for hemiarthroplasty.

Methods: This parallel design randomised controlled trial of equivalence (allocation ratio 1:1) was conducted in the department of orthopaedics, BP Koirala Institute of Health Sciences with institutional ethical clearance. Fifty eligible patients of >60 years with isolated traumatic displaced neck of femur fracture, presenting during study period from September 2017 to August 2019, were conveniently recruited and randomly allocated by using computerised Excel random number generation technique to undergo hemi-replacement arthroplasty either by lateral approach (N = 25) or by posterior approach (N = 25) and were evaluated at six weeks, three months, six months, and twelve months. Final statistical analysis was done using SPSS v.20 software among 45 patients because four deceased and one was lost to follow-up. The p-value <0.05 was considered statistically significant

Results: The functional outcome as measured by the Modified Harris Hip score at one year was 83.78 ± 5.89 for lateral approach and 80.40 ± 7.56 for posterior approach group ($p = 0.102$). The hip pain, mean blood loss, operative time, and prosthesis size was similar between the two approaches.

Conclusion: The study showed that there was no significant difference between the two approaches for hemi-replacement arthroplasty in terms of mean operating time, hip pain, and functional outcomes.

Key words: Arthroplasty; Outcome; Randomisation.

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INTRODUCTION

Among the leading causes of physical limitations and disabilities in old age are fractures in and around the hip joint. The average age of the patients in whom these fractures occur is 80 years.¹ Twenty percent of the cases in a trauma centre are usually hip fractures.² The life time probability of sustaining a hip fracture is 40-50% in women and 13-22% in men.³

The management of non-displaced femoral neck fractures is by osteosynthesis.⁴ However, 85% of neck

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of femur fractures are found to be displaced, with 97% occurring in patients over the age of 60 years.⁵ Different randomised trials have found that hemiarthroplasty is the best treatment option for the elderly, and that modern design prostheses outperform previous prostheses in terms of results.⁶ Out of various approaches, posterior approach is believed to provide better rehabilitation because of less hip muscle damage, while the lateral approach has a lower risk of post-operative dislocation. The main disadvantage cited is a higher incidence of post-operative limp attributable to abductor dysfunction.⁷⁻¹⁰

There are few randomised trials comparing posterior and lateral surgical approaches. The objective of this study was to compare the results of hip arthroplasty for femoral neck fractures using two approaches.

METHODOLOGY

This parallel design randomised controlled trial of equivalence (allocation ratio 1:1) was conducted from September 2017 to August 2019 in the department of Orthopaedics, B.P. Koirala Institute of Health Sciences, Dharan, Sunsari, Nepal. Of the total elderly patients with neck of femur fractures who presented to this university-based tertiary hospital, 19 were excluded, leaving 50 patients in the study (Figure 1). The Institutional Review Committee (Ref. 207/074/075) granted ethical approval (IRC). The research was carried out in accordance with the Helsinki Declaration for Human Experiments.

Patients with age more than 60 years, with traumatic neck of femur fractures presenting within three weeks of injury, were included in the study by convenience sampling while patients with previous hip fractures, open fractures, polytrauma/proximal femur fractures/multiple bone fractures and osteoarthritis of hip, were excluded.

Randomisation was done by using computerised Excel random number generation technique. The eligible patients were randomly allocated into one of the two groups; lateral approach group and posterior approach group, and the allocated group was noted in the admission file. After explaining about the procedure, its complications and advantages, an informed written consent was obtained from the study participants.

After adequate anaesthesia, the patients were positioned in the lateral decubitus position with the injured limb up. The lateral approach involved splitting the Gluteus Medius muscle and retracting one-third of it anteriorly to expose the anterior hip joint capsule. In case of posterior approach, the fibres of gluteus maximus were split by

blunt dissection, after which the piriformis and short external rotators were detached close to their insertion and reflected back, laying over the sciatic nerve to protect it during the rest of the procedure. In both the approaches, capsulotomy was done with an inverted T-shaped incision, which was repaired in each case after reduction of the prosthesis. The short external rotators and piriformis were repaired in case of the posterior approach. A closed suction drain of appropriate size was used in cases where operative time exceeded 90 minutes. Simple Bone cement (40 grams) was used in cases where adequate stability of the prosthesis could not be achieved, especially in those with osteoporotic bones and wide medullary canals. For proper standardisation, the prostheses used in all the cases were bipolar prostheses manufactured by Greens Surgical Private Ltd. (India). Intravenous Cefuroxime 1.5 gram was administered after skin testing in all cases within one hour of surgical incision as prophylactic antibiotics.

Intraoperative blood loss was estimated using the gauze visual analogue method, which involved counting the number of gauzes and calculating the percentage soaked after adjusting for the drain (blood collected in suction chamber), if one was used.¹¹

Patients in both the groups were ambulated in Zimmer frame from the first post-operative day. They were instructed to avoid squatting and cross-legged sitting for at least six weeks. Weight bearing was allowed from post-operative day as patient was mobilised early and no deep venous thrombosis (DVT) prophylaxis was used.

The Modified Harris Hip Score (mHHS) was used as the primary outcome measure (Table 1). The maximum score of 91 was multiplied by 1.1 to yield a final score of 100. A total score <70 was considered to be a poor result, 70-80 fair, 80-90 good, and 90-100 was considered to be an excellent result. The duration of surgery, intraoperative blood loss, prosthesis size, complications, and Visual Analogue Scale (VAS) score for pain were all measured as secondary outcomes. At six weeks, three months, six months, and one year after surgery, the mHHS and VAS scores were evaluated.¹²

The patient's demographic profile, fracture type, operating time, blood loss, and prosthesis size were recorded. Surgical site infection, prosthesis dislocation, periprosthetic fracture, prosthesis subsidence, and anterior thigh discomfort were all considered to be complications. A pillow was kept in between patient's legs to prevent adduction and was not allowed to squat or sit cross-legged. Other outcomes such as hip pain

(VAS score) and length of stay in the hospital were also recorded.

The collected data were entered into Microsoft Excel 2019 and computed in IBM SPSS Statistics for Windows, version 20 (IBM Corp., Armonk, N.Y., USA). Percent, means, and standard deviations were used to analyse descriptive data. For categorical data, the Chi-square test or Fisher's exact test was used, and for continuous data, the Independent Sample t-test or Mann-Whitney U test was used to determine the statistical significance of differences with study variables at 95% confidence intervals, p-value <0.05 was considered statistically significant.

RESULTS

The final analysis was done among 45 individuals because after two weeks of follow-up, two patients in the lateral approach and two in the posterior approach expired. One patient in the posterior approach expired after revision surgery for dislocation of prosthesis as a result of pulmonary and cardiac comorbidities. The remaining three patients died of natural causes. One patient in the posterior group was lost to follow-up after two weeks post-operatively. Thus, a total of 45 patients were analysed at final follow-up visit at one year. Among the total cases operated upon, 23 (46%) were males and 27 (54%) were females (Table 2). The majority of the patients (20, 40%) were between the ages of 60 and 65 years. There was a left sided predominance (27, 54%). The most common mode of injury was same for both the groups, which was fall on level ground (38, 76%). The most common type of fracture was transcervical (28, 56%). All of these variables did not differ significantly between the two groups, indicating that randomisation was successful.

The duration from injury to surgery, duration of surgery and duration of hospital stay were not significantly

different between the groups (Table 3). However, greater blood loss was seen in the lateral approach group than in the posterior approach group (p-value = 0.005). There was no nerve injury noted in either of the two groups. Drains were not used in any of the cases and four patients with haemoglobin less than eight gram per deciliter were transfused with one pint of fresh blood.

One (4%) patient in the lateral approach group had iatrogenic proximal femur fracture during reduction of the prosthesis for which hemi-replacement arthroplasty with encirclage was done. This patient was also included and as only one patient had such complication. In overall, it had no significant difference in time and in management of this complication as it only took 10-15 minutes extra than normal time. One (4%) case in each lateral and posterior approach group had post-operative wound infection (superficial surgical site infection) and which was treated with wound debridement and intravenous antibiotics for one week, which subsequently led to resolution of infection. One patient in the posterior approach group had prosthesis dislocation at five weeks post-operatively which required open reduction because of failure to achieve reduction by closed technique.

Head size of 45 mm was the most frequently used size of bipolar prosthesis. Most of the cases underwent uncemented hemi-replacement arthroplasty (N = 42). Cemented prosthesis was used in one case of posterior approach and two cases which underwent lateral approach with Dorr's Type C femoral stem.

In terms of hip pain as measured by VAS scores, there was no statistically significant difference between the two groups (Table 4). There was a steady increase in the mHHS with successive follow-up visits and likewise, the quality of life was found to be improving as well (Figure 2). These parameters, however, did not differ significantly between the groups at any point in time (Table 5).

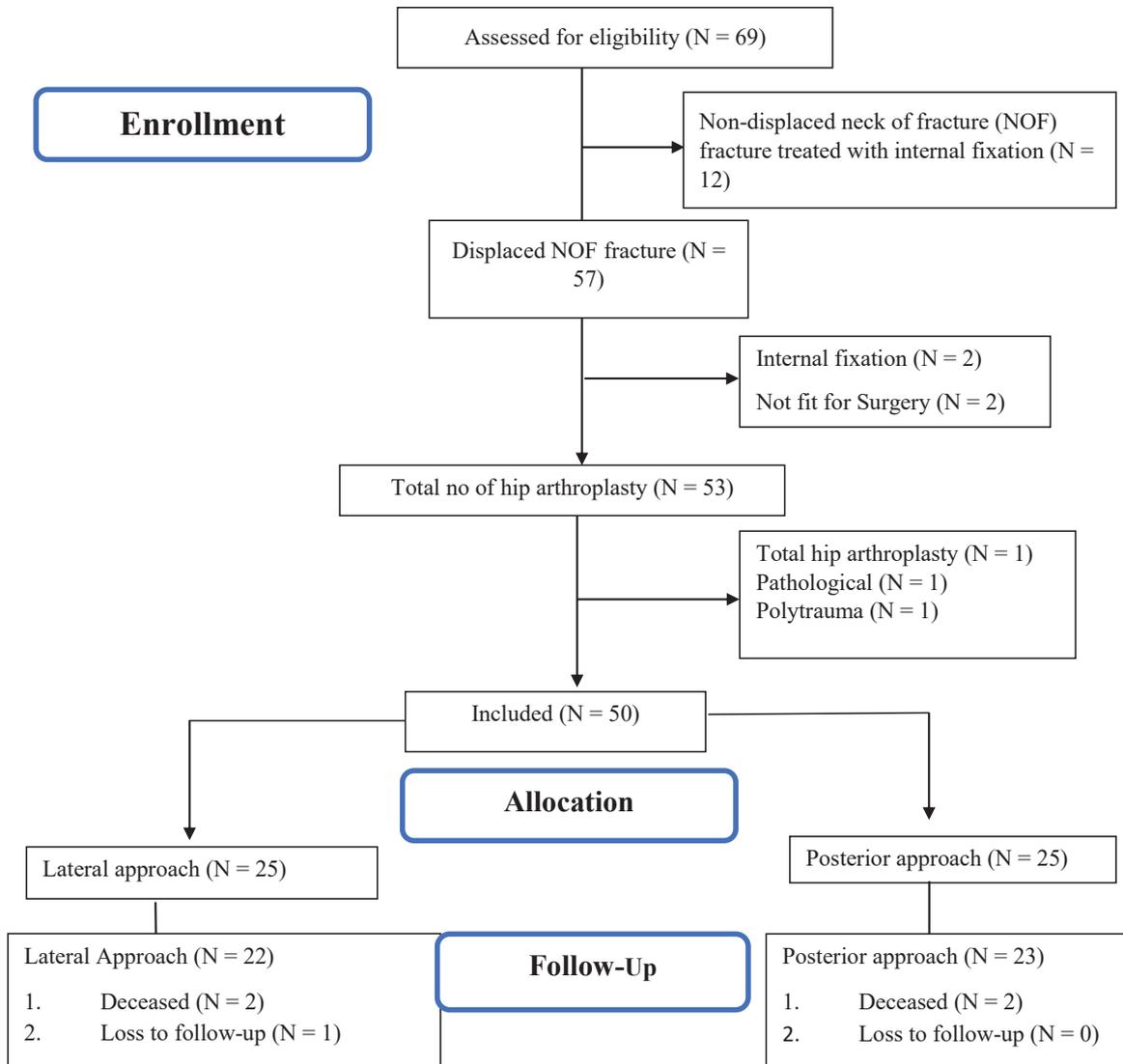


Figure 1: CONSORT flow diagram of the study

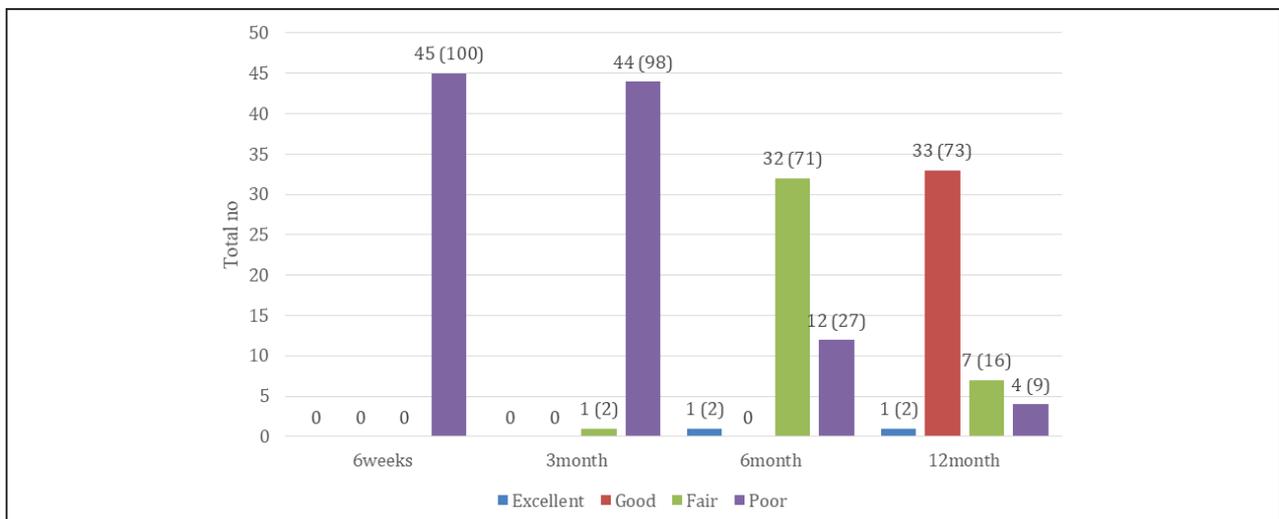


Figure 2: Modified Harris hip score qualitative assessment, n (%)

Table 1: Modified harris hip score¹²

Variable	Points	Variable	Points
Pain		Stairs	
None or ignores it	44	Normally without railing	4
Slight, occasional	40	Normally with railing	2
Mild pain, rarely moderate	30	In any manner	1
Moderate pain	20	Unable to do	0
Marked pain	10	Shoes and socks	
Totally disabled, pain in bed	0	With ease	4
Limp		With difficulty	2
None	11	Unable	0
Slight	8	Sitting	
Moderate	5	Ordinary chair for one hour	5
Severe	0	High chair for one hour	3
Support		Unable to sit in any chair	0
None	11	Public transport	
Cane, long walks	7	Able to use	1
Cane, most of the time	5	Unable to use	0
One crutch	3	Total	
Two canes	2		
Two crutches	0		
Not able to walk	0		
Distance walked			
Unlimited	11		
Six blocks	8		
Two or three blocks	5		
Indoors only	2		
Bed and chair	0		

Table 2: Demographic profile of patients

Parameters	Approach		p-value
	Lateral (N = 25)	Posterior (N = 25)	
Age distribution in years, n (%)	60-70	14 (56)	10 (40)
	70-80	9 (36)	11 (44)
	80-90	2 (8)	1 (4)
	90-100	-	3 (12)
Age in years (Mean ± SD)	69.88 ± 8.74	74.32 ± 11.24	0.126†
Gender distribution, n (%)	Male	9 (36)	14 (56)
	Female	16 (64)	11 (44)
Side involved, n (%)	Left	15 (60)	12 (48)
	Right	10 (40)	13 (52)
Mode of injury, n (%)	Fall on level ground	21 (84)	17 (68)
	Fall from height	3 (12)	7 (28)
	Road traffic accident	1 (4)	1 (4)
Classification, n (%)	Subcapital	7 (28)	7 (28)
	Transcervical	12 (48)	16 (64)
	Basicervical	6 (24)	2 (8)

* Fischer exact test; † Independent t-test; ‡ Chi-square test.

Table 3: Mean distribution of intraoperative variables

Variables	Group		p-value
	Lateral (N = 25) (Mean ± SD)	Posterior (N = 25) (Mean ± SD)	
Time of presentation after injury (days)	5.96 ± 5.53	8.12 ± 5.87	0.139§
Injury to surgery time (days)	4.96 ± 3.66	4 ± 3.41	0.284§
Duration of hospital stays (days)	2.64 ± 0.86	3 ± 1.08	0.276†
Intraoperative time (minutes)	70.2 ± 10.35	63 ± 17.32	0.08§
Blood loss (ml)	329.8 ± 56.41	284.2 ± 52.69	0.005†

† Independent t-test; § Mann-Whitney U test.

Table 4: Hip pain visual analogue scale score

VAS score	Approach		p-value
	Lateral (N = 23)	Posterior (N = 22)	
Six weeks	4.77 ± 0.429	4.52 ± 0.665	0.142
Three months	2.82 ± 1.006	3.04 ± 1.022	0.460
Six months	1.00 ± 0.436	0.96 ± 0.562	0.774
Twelve months	0.86 ± 0.468	0.78 ± 0.422	0.544

Independent t-test.

Table 5: Modified harris hip score (mHHS)

mHHS	Approach		p-value
	Lateral (N = 23)	Posterior (N = 22)	
Six weeks	40.85 ± 3.66	40 ± 3.53	0.752
Three months	59.10 ± 6.91	56.43 ± 4.84	0.140
Six months	74.25 ± 6.74	70.40 ± 7.56	0.079
Twelve months	83.78 ± 5.89	80.40 ± 7.56	0.102

Independent t-test.

DISCUSSION

Nowadays, the treatment of femoral neck fractures has shifted away from internal fixation and has moved towards hemiarthroplasty. This is due to an increased rate of failures with internal fixation (avascular necrosis and nonunion), necessitating conversion to hemiarthroplasty. The surgical strategy to be used when treating individuals with a femoral neck fracture with hemiarthroplasty is an important consideration.¹²⁻¹⁴ The lateral approach and the posterior approach are the two most common surgical approaches. The anterior portion of the gluteus medius and minimus muscles are divided and raised as a muscular sleeve to expose the anterior hip capsule in the transgluteal direct lateral approach described by Hardinge.¹⁵ Moore's posterior approach involves dividing the piriformis and short external rotators to provide exposure for subsequent capsulotomy.¹⁶

The mean operative time was longer for the lateral approach (70.2 ± 10.35 minutes), as it was less commonly used approach in the institute where the study was done; the posterior approach was the favoured surgical approach. This result was similar to the study done by Parker et al.⁷ In another similar study, even when the comparison had been confined to surgeries performed by high volume surgeons, the difference in average duration was still considerable (55 and 112 minutes, respectively).¹⁰

In this study, the mortality was 4% (two patients each) in each of the two groups, during the study period of one year (Log-rank test, p-value = 1). In the study by Parker et al.⁷, the 30-day and one-year mortality for the lateral group was four (3.7%) and 19 (17.9%), respectively, versus five (4.6%) and 20 (18.5%) for the posterior group, respectively. In the study by Mukka et al.,¹⁷ the mortality

was high regardless of choice of surgical approach. Seventy-two (39.3%) patients died during the study period of two years with no statistically significant difference between the groups (log-rank test, p -value = 0.43). In all the studies, mortality was due to pre-existing comorbidities present.

The mean blood loss in the lateral approach group was 329.8 ± 56.41 ml compared to 284.2 ± 52.69 ml in the posterior approach group (p -value = 0.005). The result was comparable to previous studies.^{7,10} There was more blood loss in the lateral approach as a result of more extensive muscle dissection and longer duration of surgery than the posterior approach for hip.

In this study, four (8%) patients had prosthesis related complications. There was one case of intraoperative proximal femur fracture in the lateral approach group, during reduction of the prosthesis that required encirclage. The rate of wound infection was similar that is one patient each (4%) in both the groups. Only one (4%) patient experienced a dislocated prosthesis after surgery using the posterior approach, which was comparable to prior research findings.^{10,17-19} Because access to the hip joint required dividing the posterior capsule and short external rotators, which function to stabilise the joint posteriorly, the post-operative dislocation occurred as a result of hip flexion and internal rotation (Note: In all cases, capsule was repaired). Thus, if the posterior approach is used in elderly bedridden patients who frequently lie with their hips flexed and adducted, the dislocation rates would be higher. Biber et al.,²⁰ in his retrospective study on 704 patients found no statistically significant difference between the two approaches regarding early surgical complications. However, the dislocation rate was higher after a posterior approach (3.9% versus 0.5 %).²⁰

The mean head size of the prosthesis used was 44.82 ± 2.99 mm and 44.6 ± 2.23 mm in the lateral and posterior approach groups, respectively. Nayak et al., in their study of the dimensions of the acetabulum in the eastern Indian population found that the mean diameter of acetabulum was 45.3 ± 3.7 mm on the right side and 44.1 ± 3.9 mm

on the left side.²¹ This correlated with the result that 45 mm head size was the most commonly used prosthesis (in 30% of patients) in the current study.

The hip pain profile as measured by VAS scores was similar between the two groups (p -value >0.05). Hip pain decreased progressively at each follow-up visit. This result was similar to the study by Parker et al.¹⁸ However, in a more recent study by Lindgren et al.,²² it was found that patients treated with the posterior approach had less residual pain and higher satisfaction scores than those treated with the direct lateral approach. It could be because in lateral approach gluteus medius has splitted pain maybe due to fibrosis or contracture of muscle fibre.

There was no significant difference in the functional outcome as measured by mHHS at six weeks, three months, six months and one year (p -values >0.05). The scores progressively improved with subsequent follow-up visits. The results were similar to prior studies.^{17,18,20}

The limitations of the study were the lack of power analysis and sample size calculation, smaller sample size of 50 patients and shorter duration of follow-up (one year), due to which late complications such as arthritis of the hip joint, peri-prosthetic fractures, prosthesis loosening/ bone loss or longevity and protrusio acetabuli could not be studied. The strength of this study was that regular follow-up assessment of every patient was done by the same physician during the entire study period.

CONCLUSION

The surgical approaches - lateral and posterior, were similar in terms of pain, functional outcome, intraoperative and post-operative complications, except for blood loss and the rate of prosthesis dislocation. Prosthesis dislocation was seen in the posterior approach suggesting that the lateral approach would be more suitable for non-compliant elderly patients. A more extensive database and meta-analyses are needed to compare the infrequent surgical complications.

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