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Research Article

Comparison of Functional Outcome and Complication Rate in Total Hip Replacement Surgery Done by Posterior Approach and Lateral Approach in Patients with Grade IV Avascular Necrosis of the Hip

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Abstract: ***Introduction:*** Total hip replacement (THR) is the standard treatment for advanced avascular necrosis (AVN) of the femoral head. Among the commonly used surgical approaches, posterior and direct lateral approaches remain the most frequently employed. However, controversy persists regarding differences in functional outcomes and complication rates between these techniques.**Aim**To compare functional outcomes and complication rates following THR performed through posterior and lateral approaches in patients with Grade IV AVN of the hip.**Materials and Methods**A prospective comparative study was conducted in the Department of Orthopaedics, Pt. J.N.M. Medical College and Dr. B.R.A.M. Hospital, Raipur, India. Forty-eight patients with Grade IV AVN of the hip who underwent THR were included. Twenty-two patients underwent THR through the direct lateral approach and twenty-six through the posterior approach. Functional outcome was assessed using the Harris Hip Score (HHS) preoperatively and at 3 weeks, 6 weeks, 3 months, and 6 months postoperatively. Complications including limp, limb length discrepancy, dislocation, infection, and other adverse events were evaluated.**Results**Both approaches demonstrated substantial improvement in HHS during follow-up. At 3 months, the lateral approach showed significantly higher HHS scores than the posterior approach (88.62 ± 4.48 vs 82.42 ± 10.39; p=0.014). However, the difference was not statistically significant at 6 months (92.52 ± 4.40 vs 88.69 ± 8.49; p=0.068). Complication rates were low and comparable between groups.**Conclusion**Both posterior and lateral approaches provided excellent functional recovery and acceptable safety profiles in Grade IV AVN of the hip. Although the lateral approach demonstrated a transient functional advantage during intermediate follow-up, both approaches yielded comparable outcomes at six months.

Keywords: Avascular necrosis, Total hip replacement, Harris Hip Score, Posterior approach, Lateral approach

INTRODUCTION

Avascular necrosis (AVN), also known as osteonecrosis of the femoral head, is a progressive pathological condition resulting from compromised blood supply to the femoral head, leading to ischemic death of bone cells, structural collapse of the femoral head, secondary degenerative arthritis, and ultimately severe functional disability [1-3]. The disease commonly affects young and middle-aged adults and represents a major cause of hip pain and loss of mobility in this population. Several risk factors have been implicated in the development of AVN, including chronic alcohol consumption, prolonged corticosteroid therapy, trauma, hemoglobinopathies, connective tissue disorders, and metabolic abnormalities [1-3].

The natural history of untreated AVN is characterized by progressive collapse of the subchondral bone and deterioration of the articular surface. In the early stages, joint-preserving procedures such as core decompression, bone grafting, and osteotomies may delay disease progression. However, once femoral head collapse and secondary arthritic changes occur, as seen in Grade IV disease, total hip replacement (THR) becomes the most reliable treatment option for restoring function and alleviating pain [2,3].

Total hip replacement is widely regarded as one of the most successful reconstructive procedures in modern orthopaedics. Since the pioneering low-friction arthroplasty introduced by Charnley, advances in implant design, bearing surfaces, fixation techniques, and perioperative care have resulted in excellent long-term survivorship and patient satisfaction [4,5]. THR has consistently demonstrated significant improvements in pain relief, gait restoration, hip function, and quality of life among patients with advanced hip pathology [4,5].
An important determinant of postoperative outcome in THR is the surgical approach employed. Various approaches have been described, including posterior, direct lateral, anterolateral, and direct anterior approaches. Among these, the posterior and direct lateral approaches remain the most widely practiced because they provide adequate exposure of the acetabulum and proximal femur while facilitating accurate component placement [6-8].

The posterior approach offers excellent visualization of the acetabulum and femur and preserves the abductor musculature, which may facilitate postoperative gait recovery. However, disruption of the posterior capsule and short external rotators has traditionally been associated with an increased risk of postoperative instability and dislocation [6,9]. Contemporary modifications involving meticulous posterior soft-tissue repair have substantially reduced this complication, yet concerns regarding stability continue to influence surgical decision-making [9].

The direct lateral or Hardinge approach preserves posterior stabilizing structures and has historically been associated with lower dislocation rates [10]. Nevertheless, splitting of the gluteus medius and minimus muscles may potentially lead to postoperative abductor weakness, limping, gait disturbances, and superior gluteal nerve injury [10,11]. Consequently, considerable debate remains regarding the superiority of one approach over the other.

Several comparative studies have evaluated functional outcomes and complications associated with different THR approaches. Jolles and Bogoch reported no major difference in long-term outcomes between posterior and lateral approaches [12]. Witzleb et al. similarly demonstrated comparable short-term recovery following both procedures [13]. Rosenlund et al. observed equivalent patient-reported outcomes after THR regardless of surgical approach [14]. Castioni et al. further reported comparable improvements in functionality and quality of life among patients treated through posterior and lateral approaches [15]. In contrast, Skoogh et al. reported higher reoperation rates due to dislocation following the posterior approach, highlighting the continuing controversy surrounding approach selection [16].

Patients with AVN differ from those undergoing arthroplasty for primary osteoarthritis because they are often younger, more active, and have greater long-term functional demands. Therefore, optimization of postoperative function while minimizing complications is of particular importance in this population [1-3]. Comparative evaluation of the posterior and lateral approaches may help surgeons select the most appropriate surgical technique and provide evidence-based recommendations for clinical practice.
Therefore, the present study was undertaken to compare the functional outcomes and complication rates of total hip replacement performed through posterior and direct lateral approaches in patients with Grade IV avascular necrosis of the hip.

MATERIALS AND METHODS

This prospective comparative study was conducted in the Department of Orthopaedics, Pt. Jawahar Lal Nehru Memorial Medical College and Dr. B.R.A.M. Hospital, Raipur, Chhattisgarh, India. Institutional Ethics Committee approval was obtained before commencement of the study, and written informed consent was obtained from all participants.

Study Population
Patients presenting with Grade IV avascular necrosis of the hip and planned for primary total hip replacement were considered eligible for inclusion.

Inclusion Criteria
- Age greater than 18 years
- Radiologically confirmed Grade IV AVN of the hip
- Willingness to undergo surgery and participate in follow-up

Exclusion Criteria
- Active infection
- Neurological disorders affecting gait
- Severe systemic illness affecting mobility
- Non-compliant patients

Study Groups
A total of 48 patients were included in the study and were allocated according to the surgical approach used:
- Group A (Posterior Approach): 26 patients
- Group B (Direct Lateral Approach): 22 patients

All procedures were performed by experienced orthopaedic surgeons under standard aseptic precautions using contemporary THR techniques.

Preoperative Assessment
All patients underwent detailed clinical examination, radiographic evaluation, routine laboratory investigations, and baseline functional assessment. Harris Hip Score (HHS) was recorded preoperatively for every participant.

Postoperative Management

Standard postoperative care was provided, including antibiotics, analgesics, thromboprophylaxis, physiotherapy, and early mobilization. Patients were encouraged to commence rehabilitation according to institutional protocols. Hip precautions were explained and reinforced during follow-up visits.

Follow-up and Outcome Assessment

Patients were evaluated at:

- 3 weeks
- 6 weeks
- 3 months
- 6 months

The primary outcome measure was functional outcome assessed using the Harris Hip Score (HHS). Secondary outcomes included postoperative complications such as:

- Limp
- Limb length discrepancy (LLD)
- Dislocation
- Infection
- Other procedure-related complications

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 20.0. Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were presented as frequencies and percentages. Independent t-tests were used for comparison of continuous variables between groups, and Chi-square tests were applied for categorical variables. Paired t-tests were utilized to assess changes in HHS during follow-up within each group. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 48 patients with Grade IV avascular necrosis of the hip underwent total hip replacement during the study period. Twenty-two patients were operated using the direct lateral approach and twenty-six patients underwent surgery using the posterior approach. Both groups were comparable with respect to demographic characteristics, disease profile, and baseline functional status, thereby allowing a meaningful comparison of postoperative outcomes.

Table 1. Baseline Demographic and Clinical Characteristics of the Study Population

Variable	Lateral (n=22)	Posterior (n=26)	Total (n=48)	p value
Mean age (years)	42.64 ± 11.49	39.12 ± 10.07	40.73 ± 10.82	0.264
Male	18 (81.8%)	21 (80.8%)	39 (81.3%)	0.611
Female	4 (18.2%)	5 (19.2%)	9 (18.8%)	
Left hip	9 (40.9%)	12 (46.2%)	21 (43.8%)	0.715
Right hip	13 (59.1%)	14 (53.8%)	27 (56.3%)	
Hypertension	4 (18.2%)	7 (26.9%)	11 (22.9%)	
Diabetes mellitus	2 (9.1%)	0	2 (4.2%)	
Seizure disorder	0	1 (3.8%)	1 (2.1%)	
No co-morbidity	16 (72.7%)	18 (69.2%)	34 (70.8%)	

Figure 1. Baseline demographic profile of study participants.

The majority of patients were males (81.3%), reflecting the known epidemiology of AVN. Right-sided hip involvement was slightly more common than left-sided disease (56.3% vs. 43.8%). Most patients had no associated co-morbidity (70.8%), while hypertension was the commonest associated medical condition. No statistically significant differences were observed between the two study groups.

Table 2. Etiological Distribution of Grade IV AVN

Etiology	Lateral (n=22)	Posterior (n=26)	Total (n=48)
Alcoholic	9 (40.9%)	12 (46.2%)	21 (43.8%)
Idiopathic	3 (13.6%)	8 (30.8%)	11 (22.9%)
Sickling	6 (27.3%)	5 (19.2%)	11 (22.9%)
Steroid induced	4 (18.2%)	1 (3.8%)	5 (10.4%)

Figure 2. Etiological distribution of avascular necrosis in both groups.

Alcohol-related AVN constituted the largest etiological category and accounted for nearly half of all cases (43.8%). Idiopathic and sickling-related AVN each contributed 22.9% of cases, whereas steroid-induced disease represented only 10.4% of the study population. Alcohol-related disease predominated in both surgical groups.

Table 3. Comparison of Harris Hip Scores Between Groups During Follow-up

Follow-up	Lateral	Posterior	p value
Preoperative	31.00 ± 4.36	31.27 ± 5.63	0.856
3 weeks	55.86 ± 8.81	57.46 ± 10.10	0.566
6 weeks	79.90 ± 4.75	74.69 ± 11.54	0.059
3 months	88.62 ± 4.48	82.42 ± 10.39	**0.014**
6 months	92.52 ± 4.40	88.69 ± 8.49	0.068

Figure 3. Mean Harris Hip Score progression during follow-up.

Both approaches demonstrated marked improvement in functional status after surgery. Baseline HHS scores were comparable between groups. Although no significant differences were observed at 3 weeks and 6 weeks, the lateral approach demonstrated significantly higher HHS values at 3 months (p=0.014). At the final six-month assessment, both groups achieved excellent functional recovery, and the difference was no longer statistically significant.

Table 4. Final Functional Outcome According to Harris Hip Score Grade

HHS Grade	Lateral	Posterior	Total	p value
Poor	0	1 (3.8%)	1 (2.1%)	
Fair	0	3 (11.5%)	3 (6.4%)	
Good	7 (33.3%)	8 (30.8%)	15 (31.9%)	
Excellent	14 (66.7%)	14 (53.8%)	28 (59.6%)	0.312

Figure 4. Distribution of final HHS grades in both groups.

At six months, excellent outcomes were achieved in 59.6% of patients, while an additional 31.9% achieved good outcomes. Only four patients demonstrated fair or poor outcomes. Although excellent results were numerically more frequent in the lateral approach group, the difference between groups did not reach statistical significance.

Table 5. Postoperative Functional Parameters: Limp and Range of Motion

Variable	Lateral	Posterior	Total	p value
Limp				
Nil	12 (57.1%)	16 (61.5%)	28 (59.6%)	
Slight	8 (38.1%)	7 (26.9%)	15 (31.9%)	
Moderate	1 (4.8%)	3 (11.5%)	4 (8.5%)	0.509
ROM Score				
Score 3	0	2 (7.7%)	2 (4.3%)	
Score 4	1 (4.8%)	2 (7.7%)	3 (6.4%)	
Score 5	20 (95.2%)	22 (84.6%)	42 (89.4%)	0.383

Figure 5. Comparison of postoperative limp and ROM scores.

Most patients demonstrated satisfactory gait recovery and preserved hip mobility at final follow-up. Absence of limp was documented in 59.6% of patients, while 89.4% achieved the maximum ROM score of 5. No statistically significant difference was observed between the surgical approaches for either parameter.

Table 6. Limb Length Discrepancy and Dislocation

Variable	Lateral	Posterior	Total	p value
LLD Present	8 (36.4%)	11 (42.3%)	19 (39.6%)	0.675
LLD Absent	14 (63.6%)	15 (57.7%)	29 (60.4%)	
Dislocation Present	1 (4.5%)	1 (3.8%)	2 (4.2%)	0.712
Dislocation Absent	21 (95.5%)	25 (96.2%)	46 (95.8%)	

Figure 6. Comparison of LLD and dislocation rates.

Limb length discrepancy was observed in 39.6% of patients and occurred with similar frequency in both groups. Hip dislocation occurred in only two patients overall, one in each surgical group. Statistical analysis demonstrated no significant association between surgical approach and either complication.

Table 7. Infection and Other Complications

Complication	Lateral	Posterior	Total	p value
Superficial infection	1 (4.5%)	0	1 (2.1%)	0.458
Protrusio acetabuli	0	3 (11.5%)	3 (6.4%)	0.151
No complication	21 (95.5%)	23 (88.5%)	44 (91.7%)	

Figure 7. Distribution of postoperative complications.

Postoperative complications were uncommon. Only one patient developed superficial wound infection, which responded to debridement and antibiotic therapy. Protrusio acetabuli occurred in three posterior-approach cases. Neither complication demonstrated a statistically significant association with the surgical approach employed.

Table 8. Improvement in Harris Hip Score from Baseline to Six Months

Group	Preoperative HHS	Six-Month HHS	Mean Improvement
Lateral	31.00 ± 4.36	92.52 ± 4.40	+61.52
Posterior	31.27 ± 5.63	88.69 ± 8.49	+57.42

Figure 8. Mean gain in Harris Hip Score after THR.

Within-group analysis demonstrated highly significant improvement in HHS at every follow-up interval in both cohorts (all $p<0.001$). Patients undergoing the lateral approach experienced a mean HHS gain of 61.52 points, while those undergoing the posterior approach demonstrated an improvement of 57.42 points. These findings confirm substantial functional recovery irrespective of the surgical approach utilized.

Overall Summary of Results

The study demonstrated that both posterior and lateral approaches for total hip replacement in Grade IV AVN of the hip provide excellent functional recovery with low complication rates. The lateral approach showed a statistically significant advantage at the 3-month follow-up; however, this benefit was not sustained at six months. Final HHS grades, postoperative mobility, dislocation rates, infection rates, and overall complication profiles were comparable between groups, indicating that both approaches are safe and effective options for managing advanced AVN of the hip.

DISCUSSION

The present study compared the functional outcomes and complication rates of total hip replacement performed through direct lateral and posterior approaches in patients with Grade IV avascular necrosis of the hip. The findings demonstrated significant postoperative improvement in both groups, with excellent functional recovery and low complication rates. Although the lateral approach showed superior functional scores at the three-month follow-up, both approaches achieved comparable outcomes at six months.

The mean age of patients included in the present study was 40.73 years, with no statistically significant difference between the two groups. Most patients belonged to the third and fourth decades of life, reflecting the well-established epidemiology of AVN. Mont et al. reported that osteonecrosis predominantly affects young and middle-aged adults and frequently results in severe disability during their most productive years [2]. Similar age distributions have been reported by Barati et al. and Patel et al. in studies evaluating THR outcomes among patients with AVN [17,18].

Male predominance was observed in the present study, with males accounting for more than four-fifths of all cases. This finding is consistent with previous literature indicating a higher incidence of AVN among men, largely attributable to greater exposure to risk factors such as alcohol consumption and trauma [19,20]. Alcohol-related AVN was the most common etiology in the present study, accounting for 43.8% of cases, which further supports these observations.

A major finding of the present study was the substantial improvement in Harris Hip Scores following surgery. Patients treated through the lateral approach improved from a mean preoperative HHS of 31.00 to 92.52 at six months, whereas patients undergoing the posterior approach improved from 31.27 to 88.69 during the same period. These results demonstrate the effectiveness of THR in restoring hip function in advanced AVN. Similar findings have been reported by Rosenlund et al., Castioni et al., and Restrepo et al., who documented marked postoperative improvements in function and quality of life following THR regardless of surgical approach [14,15,21].

Although baseline and early postoperative HHS scores were comparable between groups, the lateral approach demonstrated significantly higher scores at three months postoperatively. This finding suggests that the lateral approach may facilitate more rapid intermediate recovery. Comparable observations have been reported by Upadhyay and Kumar et al., who described improved early gait recovery and functional performance among patients undergoing non-posterior approaches [22,23]. Preservation of posterior soft-tissue stabilizers may contribute to increased patient confidence and accelerated rehabilitation during the early postoperative period.

Despite the observed difference at three months, the advantage was not maintained at six months. Both groups achieved excellent final HHS values, and the difference between approaches was no longer statistically significant. These findings are in agreement with the observations of Jolles and Bogoch, Witzleb et al., Berstock et al., and Khan et al., who concluded that long-term outcomes after THR are largely independent of surgical approach when modern operative techniques are employed [12,13,24,25].

Evaluation of final HHS grades further supports this conclusion. Excellent outcomes were achieved in nearly 60% of patients, while more than 90% attained good-to-excellent functional results. Although the lateral group demonstrated a slightly higher proportion of excellent outcomes, the difference was not statistically significant.

Similar results have been reported by Patel et al. and Reddy et al., who observed comparable long-term functional recovery following both approaches [18,26].
The assessment of postoperative gait and hip mobility revealed favorable outcomes in both groups. Most patients were free of residual limp, and nearly 90% achieved the maximum ROM score. Historically, concerns have been raised regarding potential abductor weakness following the lateral approach because of gluteal muscle splitting [10]. However, the present findings suggest that modern surgical techniques and meticulous soft-tissue handling effectively minimize this complication. Comparable observations have been reported by Gwynne-Jones et al., who found no clinically meaningful long-term differences in gait outcomes between surgical approaches [27].

Complication rates in the present study were low. Limb length discrepancy occurred in approximately 40% of patients, but the incidence was comparable between groups and did not significantly influence functional outcomes. Similar findings have been reported by Petis et al. and Sheth et al., who emphasized that minor discrepancies may occur despite careful surgical planning and are frequently clinically insignificant [6,28].

Postoperative dislocation occurred in only two patients, one in each group. The overall dislocation rate of 4.2% compares favorably with previous reports. Skoogh et al. observed higher revision rates related to dislocation following posterior THR; however, advances in capsular repair techniques have substantially reduced this risk in contemporary practice [16]. Chen et al. highlighted the importance of meticulous posterior capsular closure in maintaining postoperative stability and reducing dislocation rates [29].
Only one patient developed superficial wound infection, which resolved with debridement and antibiotic therapy. No deep infections or revision procedures were required. The low infection rate observed in this study reflects adherence to standard perioperative infection prevention measures and is consistent with previously published reports [30].

Protrusio acetabuli occurred in three patients in the posterior group; however, the association was not statistically significant. This complication is more likely related to acetabular preparation, bone quality, and surgical technique rather than the choice of surgical approach itself [6,24].

Overall, the findings of the present study indicate that both posterior and direct lateral approaches provide excellent functional outcomes and acceptable safety profiles in patients undergoing THR for Grade IV AVN. Although the lateral approach demonstrated a temporary advantage during intermediate recovery, both approaches achieved comparable final outcomes. Consequently, surgical approach selection should be individualized according to surgeon experience, technical familiarity, and patient-specific considerations rather than expectations of substantial differences in long-term results.

CONCLUSION

Total hip replacement provides excellent functional recovery in patients with Grade IV avascular necrosis of the hip. Both direct lateral and posterior approaches resulted in substantial improvement in Harris Hip Scores and achieved favorable clinical outcomes with low complication rates. The lateral approach demonstrated a significant functional advantage at three months; however, this difference was not maintained at six months. Final functional outcomes, range of motion, gait recovery, and complication rates were comparable between groups. Therefore, both approaches can be considered safe and effective options for total hip replacement in advanced AVN of the hip, and the choice of approach should be individualized according to surgeon preference, technical expertise, and patient characteristics.

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