

Comparative study of different approaches of Total Hip Arthroplasty based on inclination angle of acetabular cup and Post operative rehabilitation

Mohd Danish¹, Akhilesh Yadav¹, Ashutosh Karn², Ranvijay Pathak¹

Abstract

Introduction: Total hip arthroplasty (THA) is considered to be one of the most successful orthopaedic interventions of its generation. Joint replacement (arthroplasty) as a surgical option for end stage arthritis is well established now and millions of patients across the world have benefited. India is a country of 1.4 billion people with significant knee and hip arthritis population. According to Frost and Sullivan research, 70,000 joint replacement surgeries were performed in India in the year 2011. The most common cause of chronic hip pain and disability is arthritis. Osteoarthritis, rheumatoid arthritis, and traumatic arthritis are the most common forms of this disease.

Aims of Study: To compare post-operative outcome as implant positioning in terms of abduction angle of the cup & rehabilitation based on Harris Hip Score at 2 months and 4 months respectively in different approaches of approach of total hip replacement.

Materials and Methods: This study was conducted in the department of Orthopaedics at Max Super specialty hospital, Vaishali, Ghaziabad, UP after receiving clearance from the Ethical Committee of the institution. It was a randomized case control study. Two different groups of 32 patients each were evaluated and inclination of acetabular cup was calculated on plain radiograph, subsequently the rehabilitation was also evaluated on basis of Harris Hip score in these patients.

Results: In the present study, it was observed that mean postoperative abduction angle in Group A 47.82 ± 6.87 and Group B was 51.19 ± 7.21 degree respectively. The mean postoperative abduction angle in Group A was less compared to Group B with statistical significance. ($P < 0.05$) In the present study, it was observed that intergroup comparison of mean Harris hip score post-operative at discharge, at 2 months & 4 months in Group A and Group B showed no statistical significance. ($P > 0.05$) The intragroup comparison of mean Harris hip score post-operative at discharge, 2 months and 4 months in Group A and Group B showed statistical significance. ($P < 0.05$)

Conclusion: Present study revealed a significant statistical difference on intragroup comparison of inclination angle and rehabilitation based on Harris Hip Score in both the groups.

Keywords : Arthroplasty, Harris Hip Score, Angle of Inclination

Introduction

Total hip arthroplasty (THA) is considered to be one of the most successful orthopaedic interventions of its generation. Joint replacement (arthroplasty) as a surgical option for end stage arthritis is well established now and millions of patients

across the world have benefited. The earliest recorded attempts at hip replacement occurred in Germany in 1891, with results presented at the 10th International Medical Conference. Professor Themistocles Glück presented the use of ivory to replace femoral heads of patients whose hip joints had been destroyed by tuberculosis. India is a country of 1.2 billion people with significant knee and hip arthritis population. According to Frost and Sullivan research, 70,000 joint replacement surgeries were performed in India in the year 2011. The development

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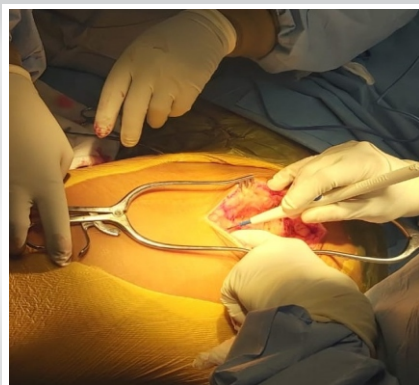


Figure 1: Incision and Exposure in Anterolateral Approach

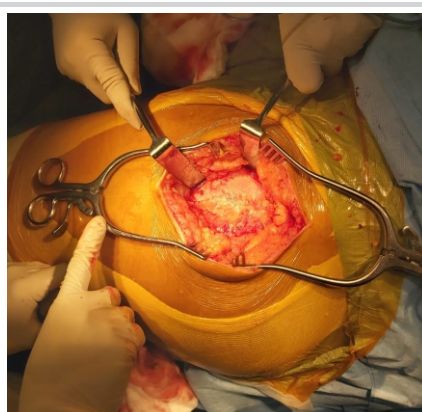


Figure 2: Deep Fascia Dissection

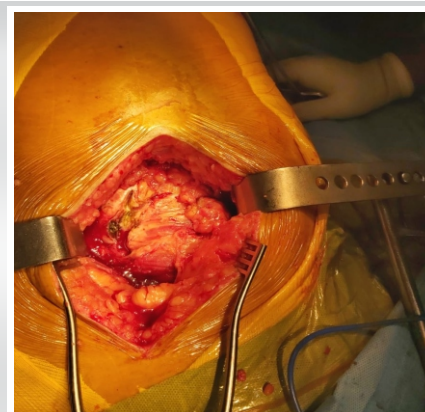


Figure 3: Exposure of Hip Joint Capsule

of modern total hip arthroplasty (THA) began in the 1960s with Charnley's low-friction arthroplasty^{1,6}. The orthopaedic surgeon Sir John Charnley, who worked at the Manchester Royal Infirmary, is considered the father of the modern THA. His low friction arthroplasty designed in the early 1960's is identical, in principle, to the prostheses used today. After years of improvement, THA is now one of the most reliable surgical interventions. Fracture involving the femoral neck is a common and serious injury in the elderly, with high associated perioperative mortality. There have been multiple publications detailing the benefits and complications of THA performed through the posterior approach and several studies detailing the results of those performed through the AL approach. Biomechanical notions are in a constant process of evolution. One such recent evolution is the adjustment from an optimized, classical posterior surgical approach to a genuine mini-posterior approach. Although the difference between these approaches may appear relatively minor, the impact on clinical outcome may well be much more significant.^[1] The use of a mini posterior approach is associated with a low rate of dislocation, a low incidence of limp, and an excellent overall functional outcome when performed with a capsular repair. The minimally invasive total hip arthroplasty has been shown to be safe and effective in achieving early postoperative improvements in pain, function and accelerated postoperative recovery ^[2,3,4,5]. The primary difference between the mini-incision and the standard posterior approach is preserving the piriformis muscle, smaller incision and elimination of numerous instruments that obscure the operative field and inevitably place tension on the delicate structures, which in turn increases the risk of neurological and soft-tissue complications. There is a paucity in the Indian literature about the comparison of these two approaches.

In this study we are comparing the implant positioning and post op rehabilitation of two different commonly performed approaches of total hip arthroplasty.

Aims of study

To compare the post-operative results and outcomes of anterolateral and mini posterior approach of total hip replacement based on post-operative outcome as implant positioning in terms of abduction angle of the cup, rehabilitation based on Harris Hip Score at 2 months and 4 months respectively, length of hospital stay, bed stay.

Materials and Methods

Study design: Prospective, randomized, comparative study.

Study area: Max Super speciality Hospital, Vaishali, Ghaziabad, UP.

Study population: Patients undergoing Total hip replacement

Study Period: One Year

Study duration: 2022-2023

Sample Size calculation and Sampling Procedure

Since only a limited number of cases satisfying the Inclusion and Exclusion criteria were expected in this Institution during the Study period, all consecutive cases satisfying the Inclusion and Exclusion criteria were included in the study without any sampling.

One of the objectives of the study was to study the implant positioning in terms of abduction angle of the cup. These values are reported as 51.2 ± 7.9 in the anterolateral group and 46.5 ± 6.2 in the mini posterior group. Using these values as SD the sample size

follows

$$n = \frac{\left(z_{\frac{\alpha}{2}} + z_{\beta} \right)^2 (\sigma_1^2 + \sigma_2^2)}{\delta^2}$$

Where $Z_{\alpha/2} = 1.96$ for 5% level of significance And $Z_{\beta} = 0.84$ for 80% power

$\sigma_1 = 7.9$ and $\sigma_2 = 6.2$ as reported by Laffosse et al^[15]

The minimum difference to be detected is $\delta = 5$ which is nearly the same as reported in the cited study.

Sample size: 32 cases in two groups.

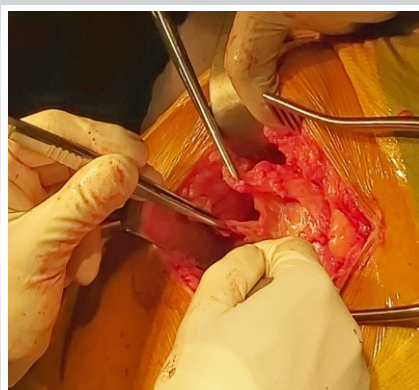


Figure 4: Capsule Around Hip Joint

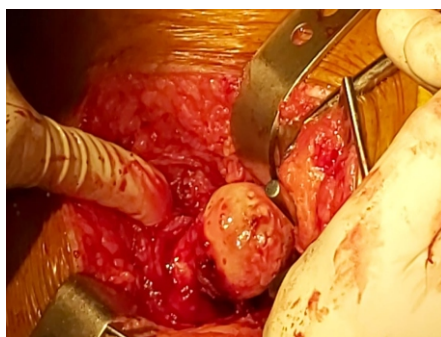


Figure 5: Exposing the Diseased Head by Dislocating



Figure 6: Incision and Exposure of Mini Posterior Approach



Figure 7: Cutting of Tensor Fascia Lata

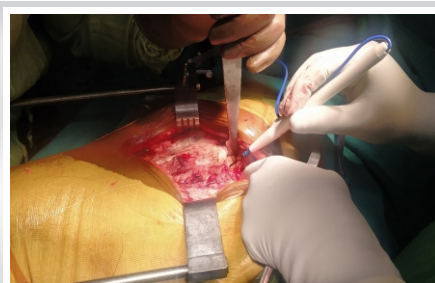


Figure 8: Exposing Short External Rotators of Hip

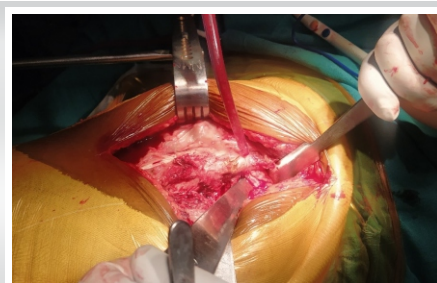


Figure 9: Identifying and Preserving the Tendon of Piriformis

Study Place: This study was conducted in the department of Orthopedics at Max Super specialty hospital, Vaishali, Ghaziabad, UP after receiving clearance from the Ethical Committee of the institution. It was a randomized case control study.

The study population included patients undergoing THR. All patients were included in the study after providing written informed consent. The patients were further randomised into either Group A (patients treated with Anterolateral approach) or Group B (patients treated with mini posterior approach). Each group comprise an equal number of patients (n=32).

Inclusion criteria

- All patients undergoing total hip replacement by anterolateral or mini posterior approach.

Exclusion criteria

1. Revision surgery
2. Cases requiring removal of osteosynthesis material before implantation
3. Those with major architectural problems.
4. Patients undergoing THR by any other approach apart from the ones included in the study.

The above figures (Fig. 1 to 11) shows the approach and basic dissection of both the approaches of total hip arthroplasty.

In an often cited paper, Lewinnek et al.[6,7] proposed a “safe zone” of cup inclination of $40^\circ \pm 10^\circ$ to minimize dislocation risk after primary THA. In their paper, all procedures were completed through a posterolateral approach. However, even if the implants are oriented based on this safe zone, dislocations still occur . All the patients underwent X Ray Pelvis (AP VIEW)

on POD 1 and after 1 month. The inclination of the cup was calculated on that basis. Moreover the rehabilitation was calculated on the questionnaire of modified Harris Hip Score at 4 different times viz preoperatively, post operatively at discharge the at 2 and 4 weeks respectively in both group of patients.

Statistical analysis

Statistical analysis was done using the SPSS software package. A chi-square test was used for dichotomous values, and tests were done for

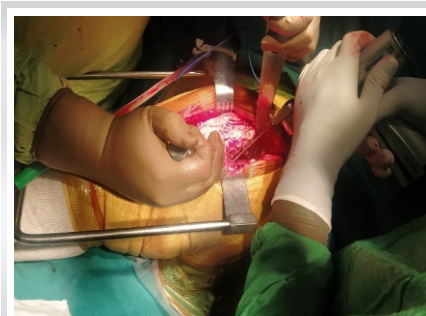


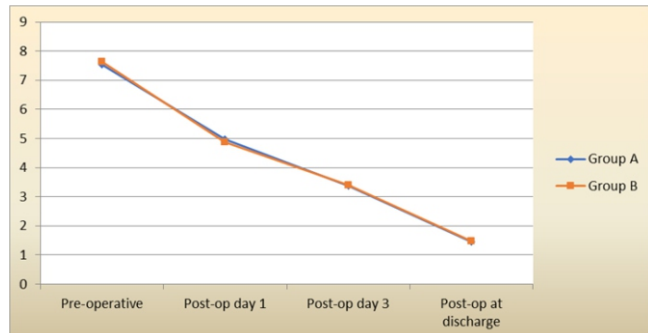
Figure 10: Cutting of the Femoral Head with Saw



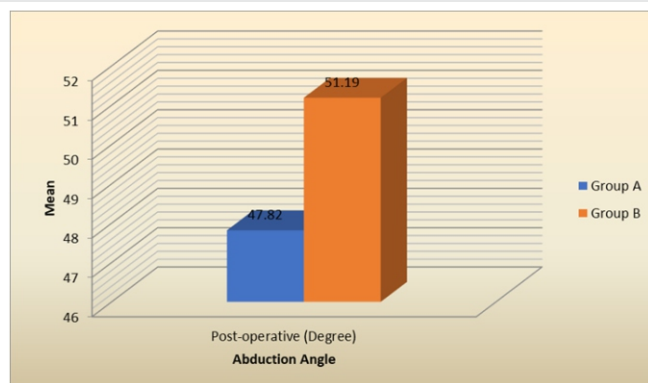
Figure 11: EXPOSURE OF ACETABULUM

Table 1: VAS scores at different intervals:

VAS score	Group A	Group B	P value
Pre-operative	7.54 ±1.02	7.63 ±0.99	>0.05
Post-op day 1	4.98 ±1.33	4.88 ±1.38	>0.05
Post-op day 3	3.37 ±1.28	3.40 ±1.45	>0.05
Post-op at discharge	1.45 ±0.92	1.47 ±1.09	>0.05
P value	<0.001	<0.001	

**Figure 12:** VAS scores at different intervals:**Table 3: Abduction angle of the acetabular cup among patients:**

Abduction angle	Group A	Group B	P value
Post-operative (Degree)	47.82 ±6.87	51.19 ±7.21	0.01 (S)

**Figure 14:** Abduction angle of the acetabular cup among patients:

continuous values. $P < 0.05$ was considered a significant difference.

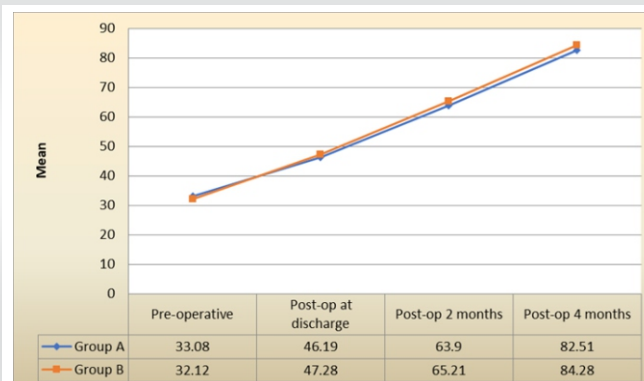
Observations and Results

The above Table 1 and below Fig. 12 showed distribution of patients according to VAS scores at different intervals. It was observed that intergroup comparison of mean VAS score at preoperative, post-operative day 1, 3 and at discharge in Group A-Patients operated by Anterolateral approach and Group B-Patients operated by Mini Posterior approach showed no statistical significance. ($P > 0.05$)

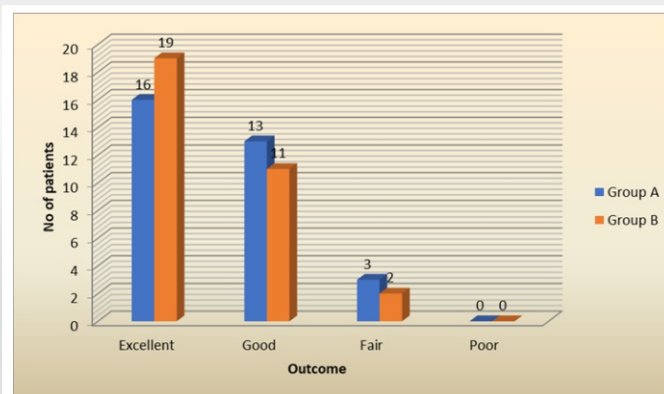
It was observed that intragroup comparison of mean VAS score at preoperative, post-operative day 1, 3 and at discharge in Group A and Group B showed statistical significance. ($P < 0.05$) The above Table 2 and below Fig. 13 showed distribution of patients according to Harris hip scores at different intervals. It

Table 2: Harris hip scores (modified) at different intervals patients:

Harris hip score	Group A	Group B	P value
Pre-operative	33.08 ±13.65	32.12 ±13.28	>0.05
Post-op at discharge	46.19 ±10.12	47.28 ±10.78	>0.05
Post-op 2 months	63.90 ±8.44	65.21 ±8.19	>0.05
Post-op 4 months	82.51 ±6.99	84.28 ±7.08	>0.05

**Figure 13:** Harris hip scores (modified) at different intervals patients:**Table 4: Outcome among patients:**

Outcome	Group A	Group B	P value
Excellent	16	19	>0.05
Good	13	11	
Fair	3	2	
Poor	0	0	
Total	32	32	

**Figure 15:** Outcome among patients:

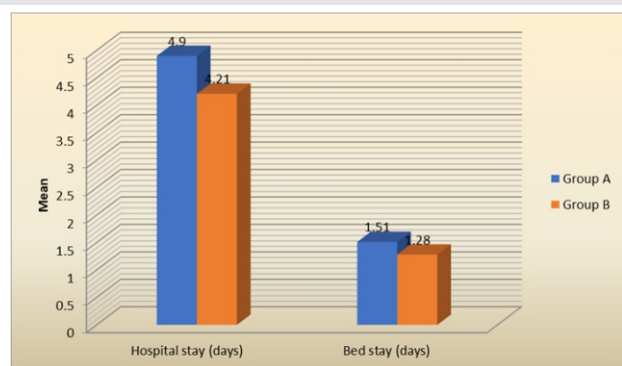
was observed that intergroup comparison of mean Harris hip score at preoperative, post-operative at discharge, at 2 months and 4 months in Group A and Group B showed no statistical significance. ($P > 0.05$) [8-13].

It was observed that intragroup comparison of mean Harris hip score at preoperative, post-operative at discharge, at 2 months and 4 months in Group A and Group B showed statistical significance. ($P < 0.05$)

The above Table 3 and below figure 14 showed distribution of

Table 5 : Distribution according to length of stay among patients:

Length of stay	Group A	Group B	P value
Hospital stay (days)	4.90 $\pm$ 2.44	4.21 $\pm$ 2.19	>0.05
Bed stay (days)	1.51 $\pm$ 1.01	1.28 $\pm$ 1.08	>0.05

**Figure 16:** Distribution according to length of stay among patients:

patients according to abduction angle. It was observed that the mean postoperative abduction angle in Group A and Group B was 47.82 ± 6.87 and 51.19 ± 7.21 degrees respectively. The mean postoperative abduction angle in Group A was less compared to Group B with statistical significance. ($P < 0.05$)

The above Table 4 and below Fig. 15 showed distribution of patients according to functional outcome. It was observed that in Group A functional outcome was 50%, 40.62%, 9.37% and 0% excellent, good, fair and poor respectively.

Similarly, in Group B functional outcome was 59.37%, 34.37%, 6.25% and 0% excellent, good, fair and poor respectively. The functional outcome in both the groups showed no statistical significance. ($P > 0.05$)

The above Table 5 and below Fig. 16 showed the distribution of patients according to hospital stay. It was observed that mean hospital stay in Group A and Group B was 4.90 ± 2.44 and 4.21 ± 2.19 days respectively. The mean hospital stay in Group B and Group A showed no statistical significance. ($P > 0.05$)

It was observed that mean bed stay in Group A and Group B was 1.51 ± 1.01 and 1.28 ± 1.08 days respectively. The mean bed stay in Group B and Group A showed no statistical significance. ($P > 0.05$)

Discussion

Total hip replacement is one of the most frequent and most successful operations in orthopaedic surgery. Thus the reliability of the procedure is of major socio-economic importance. The overall function of the hip and patient satisfaction should be high, aiming for a high percentage of patients with a "forgotten joint replacement" as soon as possible. In the present study, it was observed that intergroup comparison of mean VAS score at preoperative, post-operative day 1, 3 and at discharge in Group A and Group B showed no statistical significance. ($P > 0.05$) The intragroup comparison of mean

VAS score at preoperative, post-operative day 1, 3 and at discharge in Group A and Group B showed statistical significance. ($P < 0.05$)

In a study by J. M. Laffosse et al[14,15] observed postoperative pain was comparable between the two groups.

Similarly, Yu Ozaki et al[14] observed postoperative pain was comparable in anterior and posterior approach group with no significant difference among both groups.

In the present study, it was observed that intergroup comparison of mean Harris hip score at preoperative, post-operative at discharge, at 2 months & 4 months in Group A and Group B showed no statistical significance. ($P > 0.05$) The intragroup comparison of mean Harris hip score at preoperative, post-operative at discharge, at 2 months and 4 months in Group A and Group B showed statistical significance. ($P < 0.05$)

It was observed that in Group A functional outcome was 50%, 40.62%, 9.37% and 0% excellent, good, fair and poor respectively. Similarly, in Group B functional outcome was 59.37%, 34.37%, 6.25% and 0% excellent, good, fair and poor respectively. The functional outcome in both the groups showed no statistical significance. ($P > 0.05$)

In a study by J. M. Laffosse et al[15] observed that in terms of functional outcome there was no significant difference between the two groups at 6 weeks, 3 or 6 months.

Similarly, Yu Ozaki et al[14] observed there was no difference in preoperative or postoperative HHS between the two groups. This finding was similar to present study but in a lesser time frame.

In the present study, it was observed that mean postoperative abduction angle in Group A 47.82 ± 6.87 and Group B was 51.19 ± 7.21 degree respectively. The mean postoperative abduction angle in Group A was less compared to Group B with statistical significance. ($P < 0.05$)

In a study by J. M. Laffosse et al[15] observed the abduction angle of the cup was significantly lesser in the anterolateral group ($P = 0.02$). This finding was opposite to present study.

It was observed that mean hospital stay in Group A and Group B was 4.90 ± 2.44 and 4.21 ± 2.19 days respectively. The mean hospital stay in Group B and Group A showed no statistical significance. ($P > 0.05$) The mean bed stay in Group A and Group B was 1.51 ± 1.01 and 1.28 ± 1.08 days respectively. The mean bed stay in Group B and Group A showed no statistical significance. ($P > 0.05$)

In a study by J. M. Laffosse et al[15] observed length of hospital stay and type of discharge was comparable between the two groups.

It was observed that in Group A; 2 (6.25%) patients suffered from delayed wound healing and 1 (3.12%) patient showed reoperation. In Group B; only 1 (3.12%) patient suffered from delayed wound healing and 2 (6.25%) patients showed reoperation with no statistical significance. ($P > 0.05$)

Di Gioia et al. [8] found better early results for the Harris Hip Score at three and six months, and less cases of limp at six months. Chimento et al.[9], as with Sculco et al.[10] also found more rapid disappearance of postoperative limp. However, not all the authors confirm these results: Nakamura et al.[11] found no significant difference at six months, and Ogonda et al.[12] and Woolson et al.[13] found no difference at six weeks. With the exception of Woolson et al, the complication rate did not increase during the posterior mini-invasive approach and the positioning of implants was comparable with respect to the standard-incision posterior approach.

Conclusion

The study concludes that primary THA performed using either the anterolateral or mini posterior approach is safe and effective with low complication and reoperation rates. The mean postoperative abduction angle in anterolateral approach was less compared to the mini posterior approach with statistical significance which can be due to the orientation of the acetabulum in respective approaches after exposure. Although despite all there was just a single case of post operative dislocation in our study.

There were no clinically significant differences in perioperative outcomes including rehabilitation or discharge disposition

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflict of Interest: NIL; **Source of Support:** NIL

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